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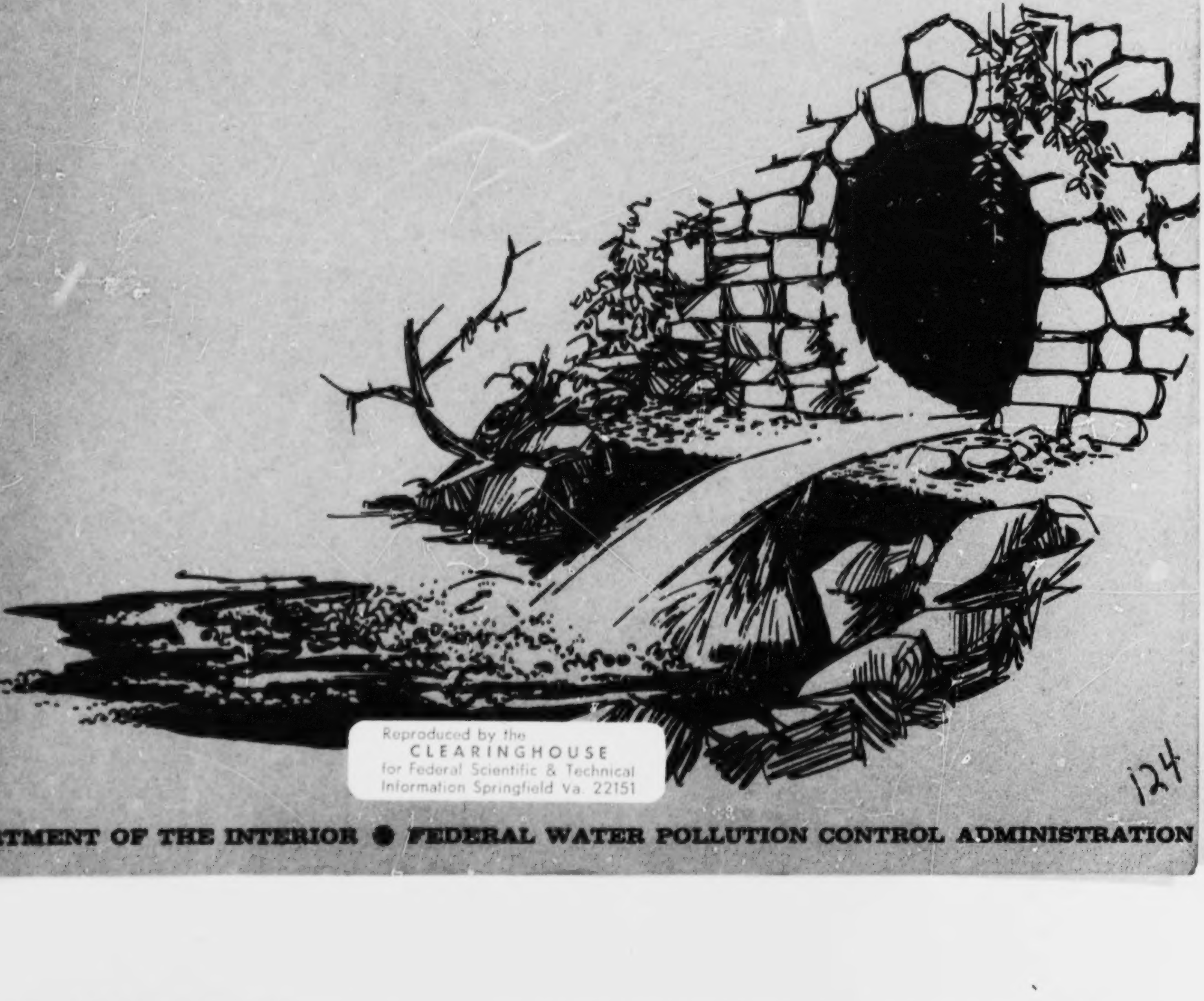
Storm and Combined Sewer Demonstration Projects

January 1970



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S. DEPARTMENT OF THE INTERIOR ● FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

WATER POLLUTION CONTROL RESEARCH SERIES

The Water Pollution Control Research Reports describe the results and progress in the control and abatement of pollution of our Nation's Waters. They provide a central source of information on the research, development and demonstration activities of the Federal Water Pollution Control Administration, Department of the Interior, through in-house research and grants and contracts with the Federal, State, and local agencies, research institutions, and industrial organizations.

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Storm and Combined Sewer Demonstration Projects

January 1970

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Division of Applied Science and Technology
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
Washington, D.C.

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SECTION 1

INTRODUCTION

Program Background

A brief outline of the background relating to the authorization and implementation of the current storm and combined sewer pollution control program of the Federal Water Pollution Control Administration is desirable to orient the reader to the need for research and development activities in this difficult technical area.

In 1964 the U.S. Public Health Service studied the combined sewer problem and published a report, "Pollutional Effects of Stormwater and Overflows from Combined Sewer Systems - A Preliminary Appraisal". This report concluded that pollution stemming from combined sewer overflows is a significant part of the total water pollution problem and that the cost of separating sanitary sewage from stormwaters would cost nationally about $30 billion. The report also recommended that alternative solutions be investigated to determine if means of control other than sewer separation could be found for application at lower cost.

The American Public Works Association Research Foundation conducted a stody of combined sewer problems in 1967 by contract for the Federal Water Pollution Control Administration. Its report,(5) "Problems of Combined Sewer Facilities and Overflows - 1967", submitted to FWPCA in December 1967 indicates that separating the Nation's combined sewers would cost about $48 billion, including the necessary plumbing changes on private property.

The report also contains several additional findings that help in describing the type and magnitude of combined sewer problems. Some of the more significant are:

1. There are an estimated 1,329 jurisdictions in the United States with a population of 54 million served in whole or in part by combined sewers. The sewer systems of an estimated 36 million persons are wholly the combined sewer type.

   The association further estimated that the use of alternative corrective measures could reduce the cost of control or treatment to $15 billion.

2. The area served by combined sewers in the 641 jurisdictions surveyed by APWA is 2,557,000 acres.

3. In the jurisdictions surveyed, the population served by separate sanitary sewers is approximately one-half that served by combined sewers - 15,425,000 and 34,080,000, respectively.

4. Of the 641 jurisdictions surveyed, 493 reported 9,860 combined sewer overflows. Sanitary sewer pumping station overflows, treatment plant by-passes and other overflow sources bring the grand total of reported overflows to 14,212.

5. Jurisdictions surveyed reported the existence of 10,025 regulators at combined sewer overflow structures. The most commonly reported types were perpendicular weirs and others of nonmechanical type. Least commonly used are mechanical types.

6. Cost of regulator maintenance varied widely, but averaged $527 per regulator per year. Twenty-two percent of the jurisdictions interviewed reported no regular inspection of regulators.

7. Fifty-three percent of the jurisdictions reported infiltration problems during wet weather.

8. Ninety-six jurisdictions reported combined sewer overflows during dry weather.

These are but a few of the survey's 29 itemized findings. Examination of those 29 listings can only lead to the conclusion that the discharge of untreated sewage from combined sewers--even during dry weather--is a significant factor in the total pollution picture. Improved techniques for dealing with the problem must be diligently sought.

The Demonstration Program

The Water Quality Act of 1965, now a part of the Federal Water Pollution Control Act, authorized the Secretary of the Interior "...to make grants to any State, municipality or intermunicipal or interstate agency for the purpose of assisting in the development of any project which will demonstrate a new or improved method of controlling the discharge into any waters of untreated to inadequately treated sewage or other waste from sewers which carry stormwater or both stormwater and sewage or other wastes...". The act authorized grants up to 50 percent of the estimated eligible cost of the project up to $1 million.

The Clean Water Restoration Act of 1966, also now a part of the Federal Water Pollution Control Act, amended the original authorization slightly so as to remove the $1 million ceiling and authorize the demonstration grants to be made in amounts up to 75 percent rather than the original 50 percent of the estimated project cost. Contracts can also be utilized to implement worthwhile projects. Since it is sometimes overlooked, it should be emphasized that projects not involving combined sewage, but planned for the purpose of controlling pollution resulting from stormwater discharges, are eligible for participation.

During the early stages of the program, which actually was implemented early in 1966, it became apparent that early control and treatment methods applied to limited extent in the United States and other countries should be among the first to be explored, with the objective of incorporating as many new techniques and applications as might be feasible. There are three basic approaches that can be utilized to solve combined sewage or stormwater pollution problems: (1) control, (2) treatment, and (3) combinations of the two.

Progress to date indicates that the development of a single control or treatment method to solve combined sewer or stormwater pollution problems is not likely. Instead, those methods which are found to provide whole or partial solutions under specific circumstances will have their place in the planning of any combined sewer or stormwater project.

The methods to be utilized must be chosen only after the specifics of the area in question are defined. The sewer hydraulics, topography, land use patterns, availability of construction sites, rainfall and runoff characteristics, location of overflow points, capabilities of the municipal sewage treatment facilities, water quality standards for the receiving waters, and other factors must be thoroughly evaluated.

The Underlying Problem

Combined sewers have "build-in" inefficiencies. They are designed to carry only specific quantities of stormwater, in addition to sewage. Such a system, therefore, of necessity incorporates planned (and unplanned) overflow points to relieve it of excess flows when runoff exceeds system design. These overflow points include trunk sewer regulators, pump stations, siphons, relief sewers, and wastewater treatment plant bypasses.

Untreated sewage discharged from combined sewers and from overloaded, nominally separate, sanitary sewers has proved to be a substantial pollution source in terms of its effects on water quality in the receiving stream--even though the percentage of total flow lost from the system by overflow may be small. The flow characteristics of combined sewers are relatively poor during dry weather when sanitary wastes alone are carried;

certain of these wastes remain in the system until a rainstorm purges the system. As a result, a large pollution load, over and above that normally carried, is discharged from this type of sewer. Thus research and development must correct this situation if we are to avoid frequent treatment plant bypassing.

Consideration of the history and function of sewerage systems leads to the immediate conclusion that control and/or treatment of combined sewer overflows or stormwater discharges are directly related to the system's efficiency. Overflows would not occur if the system were completely effective as a transport media. Federal research and development to resolve the storm and combined sewer problem, therefore, has as its main thrust, the development and demonstration of techniques and hardware which will improve system efficiency and minimize, if not completely control, untreated discharges from the system.

Development of Ideas and Application of New Or Improved Methods

Some of the approaches that have been or could be considered as parts of the solution to the problem are worthy of discussion. They can be considered under the three basic categories mentioned, the first being control methods.

Control related to the physical aspects of routing, diversion and containment of either stormwater or combined sewage. Within this broad area are:

Reduction and regulation of stormwater input to sewers, utilizing short-term surface or underground storage, land treatment measures, irrigation or percolation to groundwater, treatment and injection to groundwater, infiltration control, elimination of illicit sewer connections, and the use of special conveyance systems such as presure or vacuum sewers for the purpose of separating sanitary sewage from stormwater. Brief descriptions of one or two projects that fall within the control category will serve to illustrate approaches now being implemented.

The City of Chicago's Lawrence Avenue underflow sewer system now under construction will demonstrate and evaluate the feasibility of utilizing large-diameter tunnels for temporary storage of combined sewage during storm periods. About 3.14 miles of 12-foot tunnel and 1.76 miles of 17-foot tunnel will be used. Combined sewage will be lifted from storage after the storm and discharged to the North Side Treatment Works for treatment.

The Minneapolis-St. Paul Sanitary District, Detroit, and Seattle are installing systems for maximizing control within the sewerage systems to eliminate as much overflow from the systems as possible. Regulators are being redesigned, rebuilt or replaced; overflow points monitored with data transmitted to central logging points, and remote control of regulators installed. Based on conditions within the critical points of the system, positive control of overflows can be effected. Substantial computer capability is an integral and key factor in the workability of this approach in large metropolitan areas.

Treatment includes all potential methods of treating combined sewage or stormwater. Physical, chemical and biological methods are being evaluated as a part of the Program. Physical treatment includes screening and straining, filtration, sedimentation, and hydraulic solids separation. Chemical treatment methods might include chemical oxidation, use of polymers to improve sedimentation rates, and new or improved disinfection techniques or methods.

A project being conducted by the Dow Chemical Company for the Federal Water Pollution Control Administration is an example of chemical treatment. Polymers are being screened and evaluated toward improving the effectiveness of sedimentation as a solids removal method utilizing short detention periods. The Dow Chemical people will also attempt to optimize high-rate sedimentation tank design by comparison of tank configurations and other design aspects.

Allis Chalmers has developed a new biological treatment method which may have promise for use with combined sewage. The system is termed the BIO-DISC system. A series of disks mounted on individually powered shafts are rotated through the waste to be treated. Biological growth attaches to the disks, which can be rotated from 15 to 30 revolutions per minute. Under steady loading rates, efficiencies exceeding those of trickling filters have been obtained. Testing the system under the loads peculiar to combined sewers is being undertaken.

Biological treatment methods are, of course, difficult to apply to combined sewer overflow because of the variable waste constitutent concentrations and the extreme variability in flows. Biological systems function best under conditions as close to "steady-state" as possible, which is almost impossible to achieve during storm periods.

Combinations of control and treatment should be discussed since no one method is likely to provide "the answer" to combined sewer or stormwater pollution problems. Any combination of the methods mentioned--or others--has the potential for solving a given pollution situation. Some combinations might be: in-system or off-system storage for subsequent treatment in specially designed facilities (physical, chemical or biological), temporary or short-term storage of collected stormwater, followed by treatment and utilization for groundwater recharge, and retention of minor storm flows with pumpback to the collection system.

The Metropolitan District Commission (Boston) demonstration grant project utilizes a facility providing a minimum sedimentation period of 10 minutes with an influent flow rate of 233 MGD. Chlorinated effluent will be discharged through a 96 inch outfall to the Charles River. Solids removed in the sedimentation tank will be returned to the sewerage system for transport to the sewage treatment plant.

Somersworth, New Hampshire is implementing a project similar in basic concept to the Metropolitan District Commission project, but of different design. This project will also evaluate the use of polymers to increase the carrying capacity of the main interceptor. This feature may be of some interest as a new concept. Prior work done by the Western Company of Richardson, Texas under contract to FWPCA (6) indicates that high molecular weight polymers can increase the flow in a sewer to as much as 2.4 times the flow without polymer addition--at a constant head. This phenomenon is being investigated further and will be subjected to additional evaluation at Somersworth and at Dallas, Texas.

Mt. Clemens, Michigan is proceeding with a project which will utilize a combination of control and treatment techniques. Combined sewage will be discharged into three small lakes or "lakelets". The lakelets will operate in series and will be aerated with surface aerators. Effluent from the first two ponds will pass through microstrainers. The effluent from the third pond will be chlorinated after microstraining and discharged to the Clinton River. The potential of the lakelets for recreational uses such as boating and fishing will be explored as a part of park operation.

Many other techniques or methods are being evaluated in active projects. Use of stabilization ponds, various treatment tank designs, reduction of infiltration, improved overflow regulators, high rate trickling filters, filtration, pressure sewer systems, sewer flushing, dissolved air flotation, ultrasonic filtration, several screening techniques and other technologies are being applied and evaluated.

Other Areas of Need

There are many other areas which need thorough exploration by means of active demonstration and evaluation. Some of these are discussed below to illustrate the broad scope of interest involved in the program.

INFILTRATION

Research is also underway to find new and improved sewer sealants for infiltration control. Many of the problems associated with existing sealants, such as shrinkage upon drying, or structural weakness probably can be overcome by using modified polymeric and other plastic materials. Methods of application in both new construction and repair work are also being considered. Control of infiltration could substantially reduce dry weather flows in many cases, thereby eliminating, or at least delaying, the need for increased capacity.

A definite need exists to establish guidelines for infiltration control, including allowable volumes, types of sealants and application methods, construction materials and procedures, etc. Such guidelines would serve to upgrade the quality of original construction and help in judging the need for corrective action in existing sewers.

Building connections to street sewers are a major source of infiltration. Municipal officials and firms specializing in sewer sealing say that as much as 70-80 percent of the infiltration load occurs in these lines. The Federal Water Pollution Control Administration is, therefore, seeking practicable methods to control this.

ILLICIT CONNECTIONS

It is well known that illicit connections can cause serious local overload problems. A recent municipal (7) program demonstrated that, when a community takes the time to program the removal of illicit connections, benefits are realized in reduced storm peak flows as well as average flows.

Through a concerted effort, utilizing a public relations campaign, questionnaires, individual building inspections and a good follow-up program the Springfield, Illinois Sanitary District was able to substantially reduce the number of downspounts connected to its sewers. In combined sewer areas the reduction in connections was 88.1 percent. In areas having some separate and some combined sewers, a 90.4 percent reduction was obtained. An 89.5 percent reduction was achieved in areas where sanitary and storm sewers were completely separated. The real significance, however, was in the reduced number of public complaints.

Before the campaign the Springfield Sanitary District received as many as 300 complaints of basement flooding in a single day. After the campaign, such complaints were virtually non-existent. No such reduction in complaints occurred in adjacent areas under jurisdiction of the City of Springfield.

The effort was also successful from a cost standpoint. The Sanitary District has conservatively estimated that the cost of removing the roof leaders from the sewerage system will be returned in terms of reduced operation and maintenance costs in 16 months. While the campaign required a substantial effort over a two-year period, its effectiveness is evident in improved sewerage system efficiency.

Other communities should eliminate illicit sanitary connections to separate storm sewers since wastes from this source seldom receive treatment.

FRICTION REDUCERS

Local flooding and system bottlenecks are very obvious to the public and troublesome to routine operation and maintenance. If lack of capacity is the problem, several solutions other than replacement or relief sewers may be possible. Recent research (6) has shown that polymeric fluid friction reducers can increase the flow capacity of pipes at constant head as much as 2.4 times. These results, obtained in test-stand experiments, are now being tested under actual field conditions. A 24-inch, constantly surcharged sewer in Dallas, Texas is being used for this purpose. If proved effective, many cities will find this increased pipe-carrying capacity useful in their overloaded sewers. As with other methods, the economics will have to be evaluated for specific projects.

OVERFLOW REGULATORS

Another major problem (8) in combined sewer operations is in the area of overflow regulator devices. A first step in improving the functional efficiency of combined sewers should involve a vigorous and active regulator maintenance program since malfunctioning devices are frequently sources of trouble.

For example, Cincinnati(9) uses telemetered monitoring to detect unusual or improper overflows. A more sophisticated approach (10) is taken by the Minneapolis-St. Paul Sanitary District (MSSD) in its storm and combined sewer demonstration grant project. A computer-assisted regulator control system affords positive control of the overflow structures. Based upon rainfall and wastewater level measurements, storm flows can be diverted to the interceptor to most efficiently use the interceptor capacity. MSSD uses a helicopter for surveillance of overflow points after a rainfall.

The Cities of Detroit and Seattle also are using Federal grants to develop computer-assisted regulator control systems.

New types of regulators promise increased efficiency in sewer systems. As part of its demonstration project MSSD has gone to positive control gates and inflated rubberized-fabric dams as regulator devices.

Research is being pursued on a new type of overflow regulator that uses fluidic technology. It appears from other fluidic applications that this principle can work effectively with regulators. Again, no moving parts or electrical components are required. Improved regulator and control capability, as well as reduced operation and maintenance costs, are anticipated. The fluidic principle has also been successfully demonstrated in the control and regulation of irrigation flows.

SEWER FLUSHING

Until recently the quality of combined sewer overflows has been inadequately delineated. Current studies appear to substantiate the results of investigations (11,12,13,14) conducted during the last five to ten years. Still not firmly determined, however, are the specific causes of the very wide fluctuations in overflow quality. The "first flush" phenomenon has not been observed with any degree of regularity; perhaps we have not determined all of the factors involved.

This phenomenon is the very high pollution load that occurs during the initial stages of overflow. The pollutional concentration subsequently decreases as the storm continues, and finally reaches a steady level. Several variables undoubtedly contribute to the character of the "first flush". Solids which have settled out during dry weather flows probably are resuspended.

In an attempt to confirm the cause of the "first flush" phenomenon, work under a Federal Water Pollution Control Administration research contract is now investigating the effects of programmed sewer flushing. The effects of sewer flushing during dry weather periods, types of equipment required, and the economics of this approach are being determined.

SURFACE ENVIRONMENTAL POLLUTION

A second source of pollution load which may influence the "first flush" is "surface environmental pollution". The recently completed study(8) by the American Public Works Association reveals that a considerable solids and biochemical oxygen demand (BOD) load is present on the streets and adjacent land areas. Land use, air pollution, street sweeping schedules and efficiency, and catch basin cleaning affect the quality of the surface runoff.

Improved and conscientious "housekeeping" would reduce street litter and hence the stormwater pollution load. Street litter has been estimated to have a pollution potential equal to one percent of the raw sewage pollution load.

Materials flushed off city streets to catch basins pose another serious problem. Preliminary investigations indicate that catch basins contain a strong waste which is displaced in a ratio of one-half the catch basin volume for each equal volume of added surface runoff water. The role of the catch basin and its relative importance as a contributor of waste loads versus the associated maintenance problems needs further investigation.

STORAGE FACILITIES

Obviously, over-all sewerage system efficiency is reduced when combined sewer overflows occur. Some ways to increase the collection system efficiency have been discussed. When overflows occur, what additional methods can be used to reduce either or both the quanity and quality of wastes lost, to further improve system efficiency? A primary concern is control of the total volume. An obvious technique, in-system (15) storage, can be utilized by taking advantage of excess capacity in the trunk or the interceptor sewers.

Holding tanks are frequently considered as a means of controlling overflows. These are used in Europe (16,17,18) and have been applied to a limited extent in the United States. Concrete and steel tanks are commonly used for this type of facility. Classic examples (19) can be found in Michigan's McComb and Wayne Counties north of Detroit. The stormwater tanks of Columbus, Ohio, constructed in 1932, perhaps the first in the United States, have been recently modernized. Assisted by an FWPCA demonstration grant, the City will, for the first time, comprehensively evaluate its holding tanks to determine optimum operating procedures and facility effectiveness.

The City of Milwaukee has under construction a similar type of facility designed to utilize a mathematical model to determine the over-all size and projected efficiency. This project will include a new sludge removal technique (resuspension by agitators), and will evaluate in detail the facility's effects on water quality in the receiving Milwaukee River.

Sewerage systems are generally gravity flow, utilizing lift stations where necessary. New type of systems are needed. Vacuum and pressure type systems may prove technically and economically attractive and should therefore be considered when seeking answers to specific sewage treatment problems. By reducing the amount of water used to convey the wastes and by utilizing small transport conduits, added capacity and cost saving in the existing system may be realized.

TREATMENT FACILITIES

Converse to the concept of storing and subsequently returning wastewaters to a municipal treatment facility, is treatment at individual, remotely located outfalls. In considering these, it is important to recognize that combined sewer overflows and stormwater discharges differ in character from the sewage normally treated in sewage treatment plants. In general, it can be assumed that dry-weather sewage flows approximate steady-state conditions, while wet weather flows are completely random, as evidence by the rainfall-runoff phenomenon. Both the quality and quantity of storm flows have extreme variations. For example, the flows are from 1 to 100 or more times greater than dry weather flows, and the suspended solids content may range from 10 to 5,000 milligrams per liter (mg/l). Obviously any treatment facility must have special features to handle the wide variations and unpredictables of stormwater flows.

These same wide variations also affect storage facilities, though here it is a matter of available space. Economic considerations are just as important as technical feasibility for any corrective measure since the former is the ultimate factor in the planning and decision-making processes.

The treatment methods (23) under investigation include:

1. Microstraining
2. Dissolved air flotation (total and partial)
3. Rotating biological contactor
4. High rate plastic trickling filters
5. Ultrasonic filtration
6. High rate sand filtration
7. Cyclones
8. Oxidants
9. Chlorination and ozonization
10. Polymer additives

Results to date indicate that a combination of both storage and treatment will most likely be required in many combined sewer systems, based upon the characteristics of the sewerage system, its overflow location, the receiving body of water, available land, and many other factors.

MUNICIPAL TREATMENT PLANTS

Our discussion would not be complete without covering briefly the effects of collection system efficiency on municipal wastewater treatment plants. With regard to problems associated with excess storm flows, it would usually accomplish little to contain the flow within the collection system and then bypass it at the treatment plant. This merely moves the discharges and concentrates the effects in one location.

Consequently, it appears that auxiliary stormwater treatment units will be required to maintain continuously high levels of treatment efficiency.

THE "PLACE" OF COMBINED SEWER AND STORMWATER POLLUTION CONTROL THE TOTAL WATER POLLUTION CONTROL PICTURE

The public is demanding that we, as a nation, preserve and protect our environment. Water pollution control has top priority in achieving that end. Nature does her part to assist man in maintaining desired levels of water quality standards, as each body of water has a maximum waste assimilative capacity. For example, in the Delaware River and Estuary, it has become necessary to assign waste load allocations to each of the waste sources. Based upon today's loads, the desired water quality can be maintained by providing specified degrees of treatment.

Even as the population grows and industry expands, the discharge waste load must be maintained within the assimilative capacity of the receiving waters. As the waste loads increase, the "marginal" waste loads or sources assume greater importance. The combined sewer overflow load may amount to 5 percent of the raw load, but when you remove by secondary treatment methods 85 percent of the raw waste load received at the treatment plant, then the untreated combined sewer overflows represent a load equivalent to 33 percent of the effluent load, or 25 percent of the total load discharged. As more advanced treatment is provided, the percent of total discharged waste load representing untreated overflows can only increase, and we must not forget the many other waste sources which are seldom considered in calculating the magnitude of raw waste loadings.

Problems associated with "marginal" pollution, such as uncontrolled overflows, must be recognized now and planning initiated to improve sewerage system efficiencies so as to bring wastewater flows under control. Municipal programs with this objective cannot begin too soon because corrective action is time-consuming. Effort devoted to improving sewerage systems will pay dividends in complete control of metropolitan wastewater problems and pollution abatement.

Research and development currently undertaken cooperatively by Federal, State and local entities, including industry, will assist in finding the more efficient and less costly control and treatment methods needed to restore and maintain our water resources for maximum usefulness to man.

The tables and figures which follow illustrate the extent and impact of the combined sewer overflow problem from a national standpoint.

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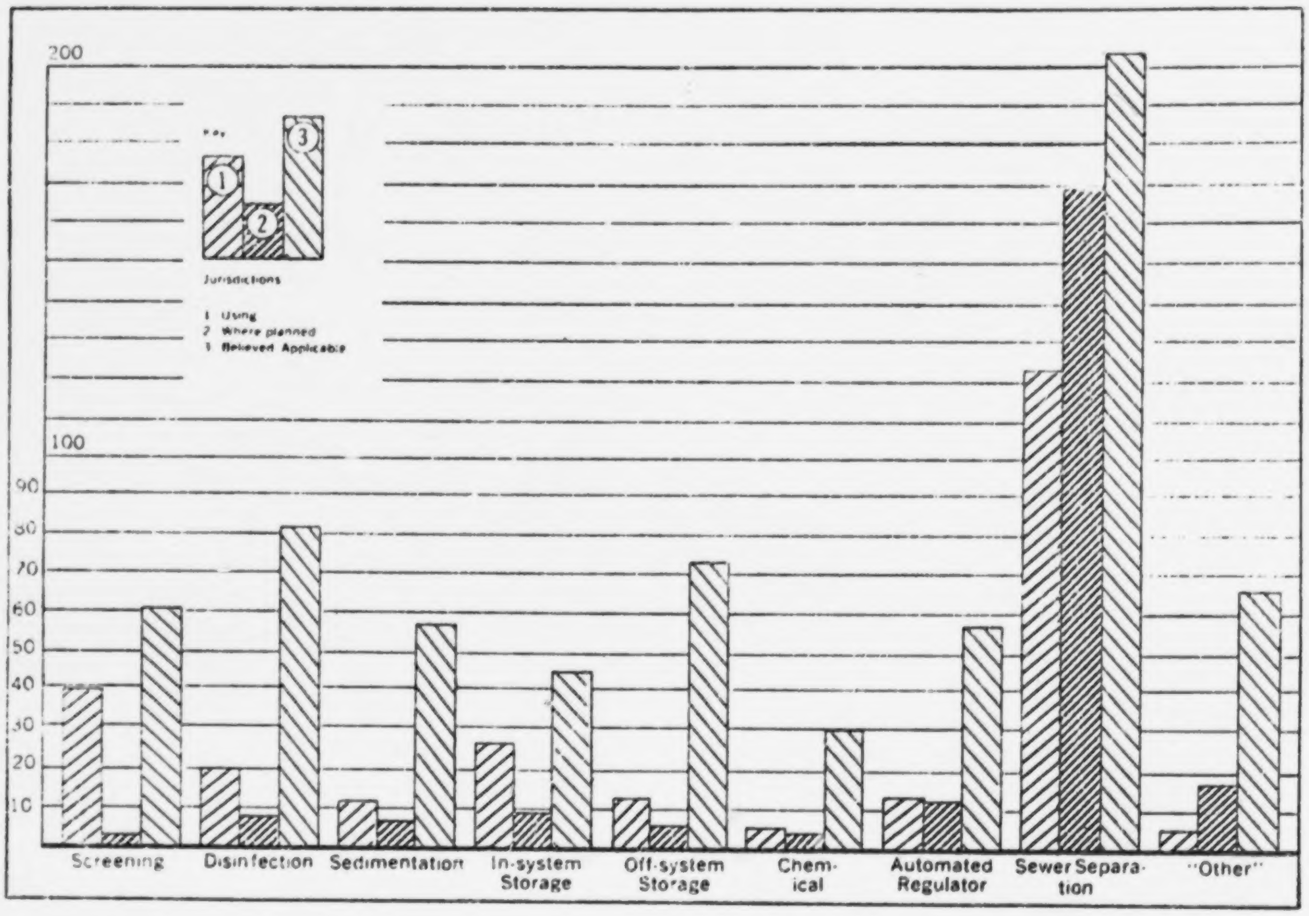
TABLE I. —ESTIMATED COST OF COMBINED SEWER SEPARATION*

STATE	Complete Separation of Combined Sewers (Public)	Plumbing Changes to Affected Buildings	Total Separation
Alabama	$ —	$ —	$ —
Alaska	8,350,000	3,950,000	12,300,000
Arizona	—	—	—
Arkansas	25,700,000	23,300,000	49,000,000
California	712,000,000	547,000,000	1,259,000,000
Colorado	35,400,000	17,000,000	52,400,000
Connecticut	373,000,000	146,000,000	519,000,000
Delaware	81,300,000	52,600,000	133,900,000
District of Columbia	334,000,000	119,000,000	453,000,000
Florida	3,720,000	1,490,000	5,210,000
Georgia	317,000,000	191,900,000	508,900,000
Hawaii	—	—	—
Idaho	15,750,000	300,000	16,050,000
Illinois	4,270,000,000	2,420,000,000	6,690,000,000
Indiana	1,710,000,000	872,400,000	2,582,400,000
Iowa	326,000,000	188,800,000	514,800,000
Kansas	109,500,000	46,000,000	155,500,000
Kentucky	490,000,000	264,390,000	754,390,000
Louisiana	—	—	—
Maine	243,000,000	116,500,000	359,500,000
Maryland	19,500,000	4,520,000	24,020,000
Massachusetts	1,425,000,000	926,330,000	2,351,330,000
Michigan	2,430,000,000	1,548,500,000	3,978,500,000
Minnesota	423,000,000	189,600,000	612,600,000
Mississippi	1,335,000	52,000	1,387,000
Missouri	972,000,000	605,000,000	1,577,000,000
Montana	20,950,000	7,450,000	28,400,000
Nebraska	263,000,000	96,700,000	359,700,000
Nevada	33,000,000	6,770,000	39,770,000
New Hampshire	196,000,000	106,450,000	302,450,000
New Jersey	990,000,000	753,500,000	1,743,500,000
New Mexico	—	—	—
New York	7,100,000,000	4,366,000,000	11,466,000,000
North Carolina	6,320,000	1,360,000	7,680,000
North Dakota	64,300,000	17,400,000	81,700,000
Ohio	2,410,000,000	1,532,800,000	3,942,800,000
Oklahoma	—	—	—
Oregon	372,000,000	219,000,000	591,000,000
Pennsylvania	2,300,000,000	1,396,500,000	3,696,500,000
Rhode Island	231,000,000	204,700,000	435,700,000
South Carolina	—	—	—
South Dakota	16,600,000	8,240,000	24,840,000
Tennessee	173,000,000	111,700,000	284,700,000
Texas	69,000,000	42,800,000	111,800,000
Utah	—	—	—
Vermont	116,500,000	28,220,000	144,720,000
Virginia	228,000,000	128,400,000	356,400,000
Washington	610,000,000	478,000,000	1,088,000,000
West Virginia	280,000,000	179,080,000	459,080,000
Wisconsin	585,000,000	408,000,000	993,000,000
Wyoming	1,420,000	557,000	1,977,000
	$30,391,645,000	$18,378,259,000	$48,769,904,000

Note: (—) Indicates no evidence available that combined sewers are used in state.

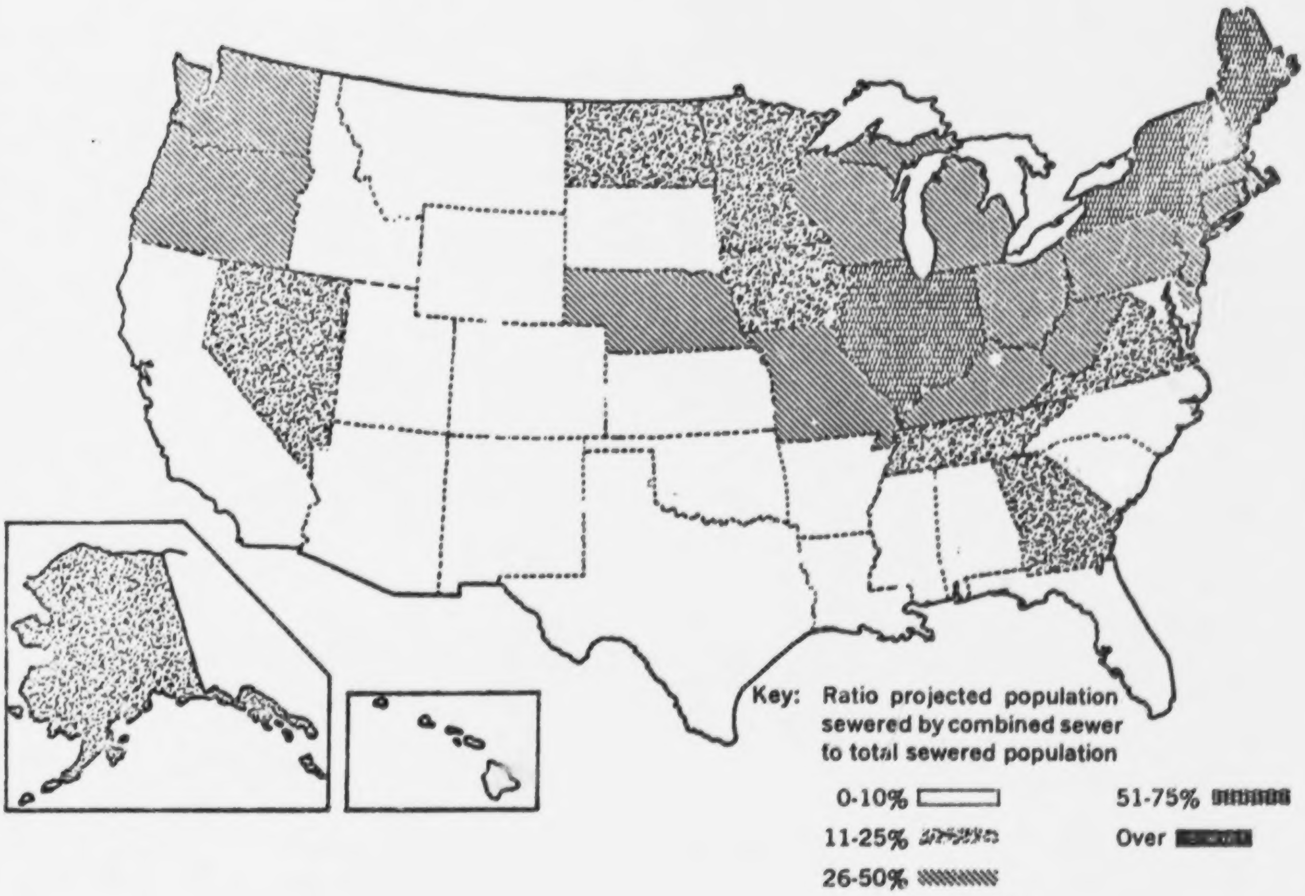
*From the American Public Works Association Research Foundation Report, "Problems of Combined Sewer Facilities and Overflows - 1967".

FIG. I. COMPARISON OF METHODS OF CONTROL AND/OR TREATMENT OF COMBINED SEWER OVERFLOWS: NUMBER OF JURISDICTIONS REPORTED USING, PLANNING CONSTRUCTION AND BELIEVING METHODS APPLICABLE. *



*From the American Public Works Association Research Foundation Report, "Problems of Combined Sewer Facilities and Overflows - 1967".

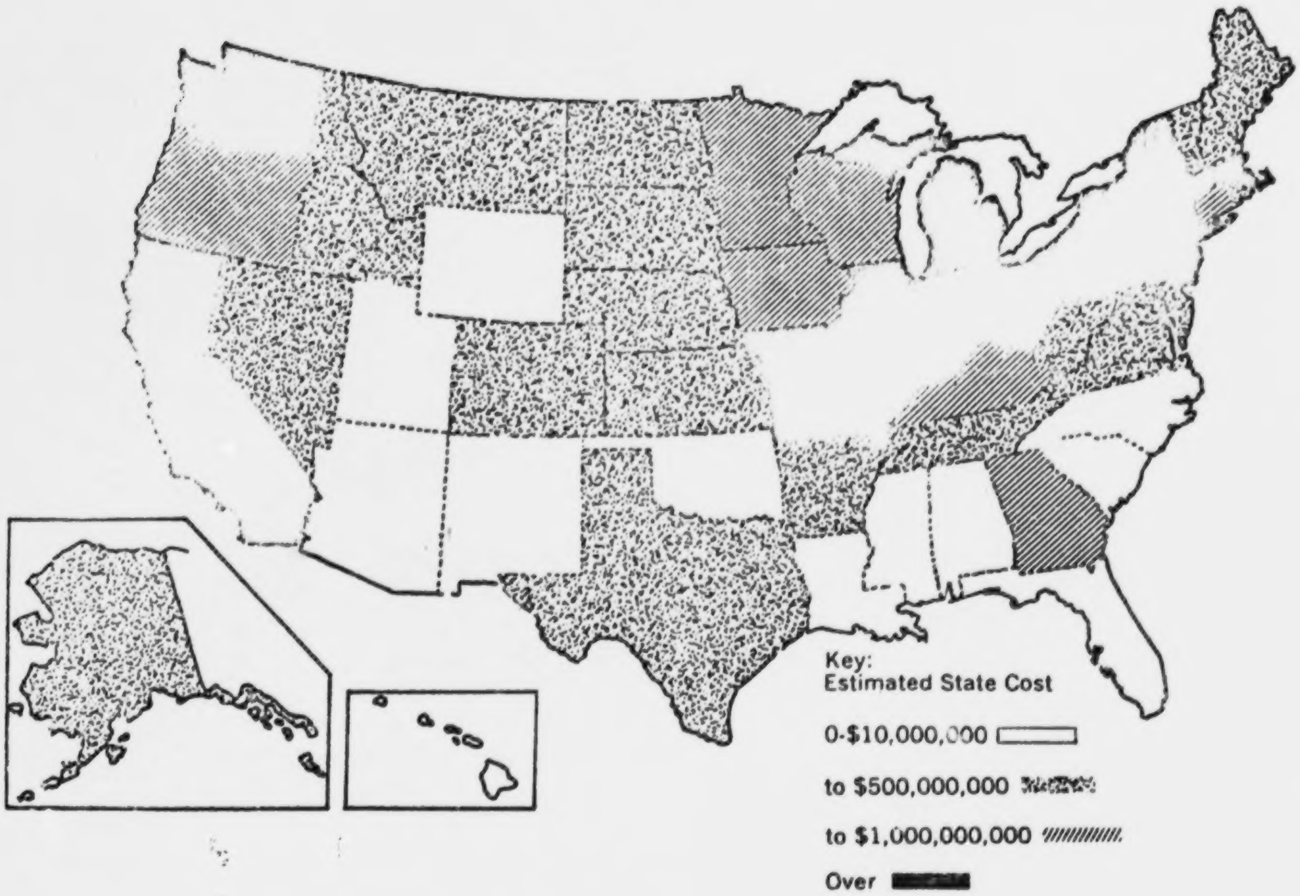
FIG. II. RELATIVE USE OF COMBINED SEWERS COMPARED TO TOTAL SEWERED POPULATION(1) BY STATES


Key: Ratio projected population sewered by combined sewer to total sewered population
0-10%
11-25%
26-50%
51-75%
Over

---

(1) Source—Statistical Summary 1962 Inventory, Municipal Wastes Facilities in the United States

FIG.III RELATIVE COST OF COMPLETE SEWER SEPARATION BY STATES.*


Key:
Estimated State Cost
0-$10,000,000 ▭
to $500,000,000 ▒
to $1,000,000,000 ▨
Over ■

*From the American Public Works Association Research Foundation Report, "Problems of Combined Sewer Facilities and Overflows - 1967".

SECTION 2

COMPLETED PROJECT REPORT ABSTRACTS

CONTRACT OR GRANT NO.	CONTRACTOR OR GRANTEE	TITLE OF FINAL REPORT	REPORT NO. (If Any)
14-12-23	Acoustica Associates	"Demonstrate Feasibility of the Use of Ultrasonic Filtration in Treating the Overflows from Combined and/or Storm Sewers", September 1967	
14-12-24	Allis-Chalmers	"Municipal Sewage Treatment with a Rotating Biological Contactor", May 1969	
14-12-65	American Public Works Association	"Problems of Combined Sewer Facilities and Overflows--1967", December 1967	WP-20-11
14-12-19	FMC Corporation	"Phase I--Feasibility of a Periodic Flushing System for Combined Sewer Cleaning", August 1967	
14-12-17	FRAM Corporation	"Strainer/Filter Treatment of Combined Sewer Overflows", July 1969	WP-20-16
14-12-467	The Franklin Research Institute	"Selected Urban Storm Water Runoff Abstracts", June 1969	WP-20-21
14-12-27	Havens and Emerson	"Feasibility of a Stabilization-Retention Basin in Lake Erie at Cleveland, Ohio", May 1968	
14-12-39	Hercules, Inc.	"Crazed Resin Filtration of Combined Sewer Overflows", October 1968	DAST-4
14-12-20	Hittman Associates	"The Beneficial Use of Storm Water", August 1968	
29-IDA-2	Meridian, Idaho	"Sewer Infiltration Reduction by Zone Pumping", June 1969	DAST-9
14-12-34	The Western Co.	"Polymers for Sewer Flow Control", August 1969	WP-20-22
14-12-146	The Western Co.	"Improved Sealants for Infiltration Control", June 1969	WP-20-18

CONTRACT OR GRANT NO.	CONTRACTOR OR GRANTEE	TITLE OF FINAL REPORT	REPORT NO. (If Any)
14-12-486	Bowles Engineering Corporation	"Design of a Combined Sewer Fluidic Regulator", October 1969	DAST-13
14-12-29	American Society of Civil Engineers	"Combined Sewer Separation Using Pressure Sewers", October 1969	ORD-4

A. PPB 1102 - COMBINED SEWER Discharges

DEMONSTRATE FEASIBILITY OF THE USE OF ULTRASONIC FILTRATION IN TREATING THE OVERFLOWS FROM COMBINED AND/OR STORM SEWERS

Acoustica Associates, Incorporated
Contract Number 14-12-23, September 1967

The feasibility of employing ultrasonic filtration for treating overflows from combined and/or storm sewers has been demonstrated in a three-month laboratory test program. This new technique involves the use of permanent-type low-head filter elements which are mounted within canisters into which ultrasonic energy is applied on a programmed basis. The beneficial effect of the ultrasonic energy is manifested in three significant ways: (1) the total quantity of influent filtered between backwash cycles increased by factors of from four to 18 times; (2) length of filter runs between required backwashing was extended from four to ten times; and (3) ultrasonic energy used during backwashing can restore the filter elements to "like-new" condition without necessitating frequent filter replacements or maintenance work of any kind.

Reductions in BOD and suspended solids averaging between 40% and 70% were obtained in a selected number of tests with raw sewage diluted in varying degree with water using 20 and 50 micron elements at filtration rates approximating 10 gpm/sq. ft. and at a head loss of from 1 to 4 psi. Based upon the tests conducted with simulated "combined" sewage, it is concluded that the ultrasonic filtration system is technically and economically feasible for full-scale waste water treatment use.

MUNICIPAL SEWAGE TREATMENT WITH A ROTATING BIOLOGICAL CONTACTOR

Allis-Chalmers
Contract Number 14-12-24, May 1969

A Rotating Biological Contactor (RBC) was installed at the Milwaukee Metropolitan Sewerage Commission treatment plant at Jones Island to demonstrate the feasibility of treating municipal waste with an RBC system.

The RBC system effectively treated domestic sewage at high loading rates. Ninety percent COD removal was attained at a loading of 350 to 400 pounds of COD per day per thousand cubic feet of disc volume. Pounds of COD removed increased with pounds of COD applied. Efficiency of treatment improved with increased retention time. Percent BOD removal was approximately five percent greater than percent COD removal. Lower disc speed resulted in a slightly lower efficiency. Lower strength wastes are not as efficiently treated as higher strength wastes at the same organic loading. Recovery from high hydraulic loading is rapid.

This report was submitted in fulfillment of Contract 14-12-24 Modification 2 between the Federal Water Pollution Control Administration and Allis-Chalmers Manufacturing Company.

PROBLEMS OF COMBINED SEWER FACILITIES AND OVERFLOWS -- 1967

American Public Works Association
WP-20-11, December 1967

The effects and means of correcting combined sewer overflows and separate storm and sanitary sewer discharges were inventoried on a national basis in 1967 and compiled in this report. On-site personal interviews with the public officials of approximately 900 communities in the United States collected over 250,000 pieces of data which have been analysed and grouped by State, river basin, and population group to define the problems of combined sewer facilities and overflows. Nationwide projections were made for major items of interest including, area and population served by combined sewers, overflow locations, type and number of regulators, associated land and water uses, estimates of costs for sewer separation by States, alternate control and/or treatment methods and consideration of other aspects of the overall problem. Findings, Conclusions and Recommendations are presented in summary form.

This report was submitted in fulfillment of Contract No. 14-12-65 between the Federal Water Pollution Control Administration and the American Public Works Association -- Research Foundation.

PHASE I--FEASIBILITY OF A PERIODIC FLUSHING SYSTEM FOR COMBINED SEWER CLEANING

FMC Corporation
Contract No. 14-12-19, August 1967

Published literature has shown that one of the causes of pollution from stormwater overflow of combined sewers is the deposition of pollutional solids during dry weather flow followed by pick up of the pollutional material during storm flow when the flow must be bypassed. As a solution to this problem it has been proposed that a flushing system be used to periodically cleanse the sewers during dry weather and convey the solids to the treatment plant.

This is a final report of the work done by FMC Corporation, Central Engineering Laboratories under a six month contract, Contract 14-12-19, from the Federal Water Pollution Control Administration to study the Feasibility of a Periodic Flushing System for Combined Sewer Cleansing.

Under this Phase 1 contract a study was made of sewer flushing practices, application requirements and hydraulic theory, an investigation was made of sampling methods and equipment, and flushing test equipment was designed for use in Phase II and the cost of Phase II was estimated.

In the course of the various background studies it was confirmed that additional detailed information is needed in order to apply a periodic flushing system to actual combined sewers. It was also concluded that the existing information on sewer flushing indicated a good possibility that a periodic flushing system would be feasible for reducing pollution from combined sewer stormwater overflow.

The detailed information needed to apply a sewer flushing system must be determined by a large number of controlled experiments of flushing effectiveness.

The design of flushing evaluation equipment for use in Phase II has been carried to the point that cost estimates can be made for construction of the equipment. A description of the design and the cost estimates are included in this report.

It is recommended that this program be continued into Phase II in order to determine the effectiveness of flushing under various conditions. The work in Phase II should also include the integration of the test results into a design procedure, the design and development of flush station equipment and control systems, the selection and approval of a demonstration location for Phase II, and the preliminary design and cost estimation for the Phase III demonstration.

STRAINER/FILTER TREATMENT OF COMBINED SEWER OVERFLOWS

Fram Corporation
WP-20-16, July 1969

The primary objective of this feasibility study was to evaluate the principle of a 'self-cleaning strainer, self-cleaning filter' concept for the treatment of combined sewer overflows. The anticipated goal was to design and construct a prototype system capable of handling up to 1000 gallons per minute with a B.O.D. reduction near 60 percent, and with the capability of automatic operation in remote locations.

A combined sewer overflow in Providence, Rhode Island, was sampled and analyzed to determine the type and amount of contaminant discharged into the receiving stream. The average concentration was determined to be nearly equal to pure domestic sewage. It was also determined that the analysis reported for overflows is very dependent on the exact sampling method used. Automatic sampling devices utilizing small diameter tubing do not take a representative sample since the suspended solids distribution is not uniform over the cross-sectional area of the discharging stream. Based on overflow sample analysis data (samples taken manually), a synthetic substrate solution was prepared to evaluate a forced flow self-cleaning strainer for significant operating variables.

The strainer and filter systems were evaluated using the synthetic substrate, primary influent to two separate municipal treatment plants, fresh sewage solids and actual combined sewer flow. It was demonstrated that the strainer model produced consistent suspended solids removal rates near 35 percent under highly varying load conditions, at a flux of 25 gallons per minute per square foot.

The diatomite study showed operational success could be achieved at a 50 percent organic reduction rate at 4 gallons per minute per square foot of area, but at a minimum estimated operating cost of $1.50 per 1000 gallons.

This report was submitted in fulfillment of Contract 14-12-17 between the Federal Water Pollution Control Administration and the Fram Corporation.

SELECTED URBAN STORM WATER RUNOFF ABSTRACTS

The Franklin Research Institute
WP-20-21, June 1969

Selected Urban Storm Water Runoff Abstracts is a compilation of abstracts summarizing articles from a variety of technical publications, covering the subjects of urban runoff, storm water discharge, storm sewers, and combined sewers--together constituting "the problem of urban drainage". Articles on more general subjects, such as "sewerage" or "sanitary engineering", and topics not closely related to storm water, such as "agricultural runoff", have been excluded.

The present work represents an effort to index, expand and update the annotated bibliography, Storm Water Runoff from Urban Areas, issued in April 1966 by the Cincinnati Water Research Laboratory of the Federal Water Pollution Control Administration. Among the 573 abstracts presented are 386 not previously included, which summarize articles dated both earlier and later than 1966, so that the present compilation represents as complete a bibliographic record as possible of storm water articles, up to--and to some extent including--1968. The 187 abstracts from the 1966 edition were indexed, but not otherwise edited or re-evaluated. For convenience, the abstracts are classed in eleven sub-topic categories, and arranged by abstract number within each category.

Since most of the papers fit into more than one category, the cumulative subject index at the end of the volume provides the necessary access to individual concepts by referring to each pertinent abstract number. Each item includes a bibliographic citation, an abstract, and a set of indexing descriptors (subject terms listed in the Water Resources Thesaurus, November 1966 edition) and identifiers (newly suggested subject terms). The most important index terms are marked by an asterisk. The format of abstract presentation follows the one used by the Department of the Interior's Water Resources Scientific Information Center for its periodical, Selected Water Resources Abstracts.

This report was submitted in fulfillment of Contract 14-12-467 between the Federal Water Pollution Control Administration and The Franklin Research Institute.

FEASIBILITY OF A STABILIZATION-RETENTION BASIN IN LAKE ERIE AT CLEVELAND, OHIO

Havens and Emerson
Contract No. 14-12-27, May 1968

A feasibility study was conducted of a large stabilization-retention basin to be constructed in Lake Erie at Cleveland, Ohio. The stabilization is viewed as a possible alternative to separation of a combined sewer system. The proposed basin would treat flows from a number of large combined sewer overflows, from several polluted streams, and effluent from a large secondary wastewater treatment plant. Treatment would consist of bio-oxidation, sedimentation, stabilization and disinfection. A shoreline collection system is included to convey flows to the basin.

The chemical, biological, physical and structural aspects of the proposed basin were studied, and the probable benefits to water quality and the effectiveness of the basin as a treatment device were evaluated. Estimates of cost of the basin and collection system were prepared, and it was concluded that the stabilization basin would provide a higher degree of pollution abatement than would separation of sanitary and storm sewers, at about one-third the cost.

CRAZED RESIN FILTRATION OF COMBINED SEWER OVERFLOWS

Hercules, Incorporated
DAST-4, October 1968

The feasibility of developing a self-cleaning, self-adjusting filtering device constructed of cylindrical structure of fibers laid down in predetermined patterns by a winding process and bonded in place by resins was investigated. The permeability of the structure is imparted by a mechanical cracking or carzing of the resin. The tube would act as a normal pipe under open channel flow. Surcharging or pressurization to 4 psig would cause the walls to become permeable. Filtration runs indicated a 62% reduction of suspended solids in the filtrate. However, sustained runs could not be realized. The self-cleaning aspect was not demonstrated. This report was submitted in fulfillment of Contract No. 14-12-39 between the Federal Water Pollution Control Administration and Hercules Incorporated.

SEWER INFILTRATION REDUCTION BY ZONE PUMPING

Meridian, Idaho
DAST-9, June 1969

The intent of this project was to field demonstrate the reduction of ground water infiltration into sanitary sewers by pumped draw down of the water table in the sewer area assuming the **geology** precipitation and local irrigation practices were amenable to rapid and wide enough zones of influence. It was demonstrated that the water table was lowered and the volume of flow to the treatment plant was reduced. Previously, wet basements were dried. The water table was not lowered uniformly, nor were the characteristics of the relevant geology as uniform as expected. For 140 square blocks, 70 pump units would be required at an average cost of $40,000 per unit and a total power bill of $122.50 per day. This is not economically favorable when compared with other corrective measures available at this location. This report was submitted in fulfillment of Grant No. 29-IDA-2 from the Federal Water Pollution Control Administration to the City of Meridian, Idaho.

POLYMERS FOR SEWER FLOW CONTROL

The Western Company
WP-20-22

Six water-soluble polymers were investigated to determine their effects upon aquatic flora and fauna, flow characteristics of wastewater, and the operation of a wastewater treatment plant.

It was found that the polymers and gels, in the magnitudes tested, were not toxic to bacteria, algae, or fish, and did not act as a nutrient for algae growth.

Based upon calculations obtained from flow test data, a maximum flow increase of 2.4 times the flow prior to injection could be obtained if a constant head was maintained. Laboratory flow test data indicated that if flow rates were held almost constant prior to and during polymer injection, a reduction in the static head occurred as a result of friction reduction within the fluid.

The most effective polymers in providing energy reduction were Polyox Coagulant-701, WSR-301, and AP-30; however, AP-30 required higher polymer concentrations to obtain equivalent flow characteristics.

In field tests on a 24-inch diameter line, it was found that polymer concentrations of between 35 and 100 mg/l, decreased frictional flow resistance sufficiently to eliminate surcharges of more than six feet.

Based upon an economic analysis, the average annual cost of new construction was approximately five times the cost of using polymers during peak storm-flow periods.

This report was submitted in fulfillment of Contract 14-12-34 between the Federal Water Pollution Control Administration and The Western Company.

IMPROVED SEALANTS FOR INFILTRATION CONTROL

The Western Company
WP-20-18, June 1969

The objective of this program was to develop new, more effective sealants for sewer line leaks (leaking joints, cracks and large holes). This purpose was achieved, and all equipments and materials investigated, tested or compared are presented, along with test results, supporting data, conclusions and recommendations. A wide range of candidate materials was surveyed, and weaknesses of rejected materials were noted. Meanwhile, specific properties of acceptable materials were ascertained and materials having these properties were identified. These latter materials were subjected to tests designed to demonstrate their effectiveness as sealants. Cost/effectiveness of the new sealant materials was compared with that of present sealant materials. It was concluded that infiltration adversely influences sewer system operating costs and effectiveness, and that leakage repair systems are limited in their effectiveness. Several sealants developed during the program were demonstrated to be able to effect strong, permanent repairs. No significant cost increase beyond that experience with present sealers was indicated. Some present sealant application equipment can be modified for use with the new materials, but new equipment designs are described and recommended. Too, long-term field tests of the materials are recommended.

This report was submitted in fulfillment of Contract 14-12-146, between the Federal Water Pollution Control Administration and The Western Company of North America.

DESIGN OF A COMBINED SEWER FLUIDIC REGULATOR

Bowles Engineering Corporation
DAST-13, October 1969

The objective of this program was to demonstrate feasibility, and to develop a workable configuration for a combined sewer Fluidic regulator, whose purpose is to minimize combined sewer discharge while protecting interceptor sewers from overloading during storm flows. A second objective was to develop design procedures and criteria for the general application of this concept to municipal sewer diversion requirements, including preliminary investigations of construction methods, costs, and maintenance requirements. A third objective was to establish a plan and location for an operational demonstration of the concept with a cooperating municipality.

All objectives were successfully met. A generic Fluidic Regulator configuration was evolved which diverts 0 to 75% of the combined sewer flow away from the interceptor as a function of water level sensed in the interceptor sewer, or combined sewer, in either an analog or digital operational mode. Application design criteria were evolved for a range of small to medium sized municipal sewers, in terms of a few basic parameters. Projected installation costs are only slightly more than for conventional diversion structures; while the anticipated construction and maintenance requirements are simple and minimal.

The City of Philadelphia was established as the demonstration site, and a demonstration unit should become operational in late 1970. Recommendations were made for experimental activity to improve regulation linearity; expand application size limit, and to better definitize construction methods and costs.

This report was submitted in fulfillment of Contract 14-12-486, between the Federal Water Pollution Control Administration and the Bowles Engineering Corporation.

COMBINED SEWER SEPARATION USING PRESSURE SEWERS

American Society of Civil Engineers
ORD-4, October 1969

This report is concerned with the separation of community wastewaters and runoff from rainfall and snowmelt in areas presently served by combined and intercepting sewers. Separation is accomplished by withdrawing the wastewater fraction of flows from existing plumbing systems and passing it through a sequence of added systems components as follows: (1) a storage, grinding and pumping building; (2) pressure tubing fished from the unit through each existing building sewer into the existing combined sewer; and (3) pressure piping inserted in that sewer and extending to the existing intercepting sewers that carry the wastewaters to treatment and disposal works. Runoff from rainfall and snowmelt, thus unencumbered by wastewaters, is removed from the community through the residual passageways of the one-time combined sewer system, which has thus become a combination of a new pressure conduit system within an old gravity conduit system.

The feasibility of this scheme of separation, the selection of available systems components and the development of required new systems components are described in this report on the basis of information drawn from 25 project reports and technical memoranda.

The feasibility of storing, grinding and pumping sewage from individual residences has been established; and standard comminuting and pumping equipment will be satisfactory for serving larger buildings. Acceptable types of pressure tubing are available that can be pushed and pulled through existing building drains and sewers. Pressure conduits can be suspended inside combined sewers that can be entered by workmen. There are combined sewer areas that can be separated most effectively by a version of the method investigated, but generally pressure systems will cost more than new gravity systems. New capabilities developed appear to be of potentially greater use for applications other than separation, such as new construction including utility corridors, and introduce viable alternatives for design of wastewater sewerage.

This report was submitted in fulfillment of Contract Number 14-12-29 between the Federal Water Pollution Control Administration and the American Society of Civil Engineers.

B. PPB 1102 - STORM WATER RUNOFF

WATER POLLUTION ASPECTS OF URBAN RUNOFF

American Public Works Association
WP-20-15, January 1969

A study was conducted to determine the factors in the urban environment which contribute to the pollution of urban storm water runoff and to determine methods to limit this source of water pollution. It was found that street refuse--litter--could be a significant factor when the nature of the shock discharge of the pollution is considered.

An evaluation was made of the efficiency of street cleaning methods and limitations of commonly used equipment explored.

Catch basins in conjunction with street inlets to the storm water disposal system were also determined to be a potential major source of pollution as large quantities of septic liquid are released during periods of storm water runoff.

Other potential sources of pollution considered included air pollution, roof discharges, and chemicals used in the urban environment. Surveys were made to determine national patterns, a comprehensive set of "typical" ordinances governing a wide sampling of possible sources of urban storm water runoff pollution were compiled and are included in the report.

Findings and Recommendations are included in summary form.

This report is submitted in fulfillment of Contract WA-66-23 between the Federal Water Pollution Control Administration and the American Public Works Association.

THE BENEFICIAL USE OF STORM WATER

Hittman Associates
Contract No. 14-12-20, August 1968

This report contains a discussion of the work performed in the analysis and optimization of the system; the conceptual designs of potable, sub-potable, and pollution control systems; the conceptual design of a system for controlling pollution using a "conventional design" approach, the results of the system evaluation and plans for the demonstration of the local storage, treatment, and reuse of storm. The appendices to this report include the derivations of the hydrology equations, survey reports on water usage and the public acceptance and legal aspects of reuse, design reports on the "conventional" and demonstration system, detailed estimates on the cost of the demonstration program, and descriptive information on packaged water treatment plants.

Storm water runoff from local areas is normally considered to be a form of wastewater. Use of storm water from surface water supplies normally occurs only after the runoff has undergone natural treatment processes and becomes a concentrated source. In this report, the local utilization of storm water runoff is referred to as "reuse" based on the normal classification as wastewater and to distinguish the type of usage from the normal use of surface water supplies.

This final report covers the work performed by Hittman Associates, Incorporated, in cooperation with the Rouse Company and the "new city" of Columbia, Maryland, on the collection, storage, treatment, and reuse of storm water as a means of pollution control and water supply augmentation. This work was performed for the Federal Water Pollution Control Administration, U.S. Department of the Interior, under Contract 14-12-20.

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SECTION 3

ACTIVE PROJECT INFORMATION SHEETS

a. 1102 Combined Sewer Discharges

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Springfield Sanitary District, 3-ILL-1	Ralph Christensen	Darwin Wright	39
Metropolitan District Commission, Boston, Mass., 11023 FAT	Allyn Richardson	George Kirkpatrick	41
City of Detroit, 11022 FAX	Lawrence O'Leary	Darwin Wright	42
City of Milwaukee, 11023 FAU	Clifford Risley	Darwin Wright	43
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City of Chippewa Falls, Wisconsin, 11023 FIY	Louis Breimhurst	Darwin Wright	45
East Chicago Sanitary District, Ind., 11023 FAV	Clifford Risley	Darwin Wright	46
METRO, Seattle, Wash., 11022 ELK	William Clothier	George Kirkpatrick	48
City of Columbus, Ohio, 11023 FAL	Robert Feder	Francis Condon	49
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City of Mount Clemens, Mich., 11023 FAR	Lawrence O'Leary	Francis Condon	64
City of Cleveland, Ohio, 11023 EZW	George Harlow	William Rosenkranz	65
City of Dallas, Texas, 11023 FAW	George Putnicki	George Kirkpatrick	66
City and County of San Francisco, Calif., 11023 DXC	William Bishop	Darwin Wright	74
Board of County Commissioners, Montgomery Co. Ohio, 11022 DHQ	Eugene Harris	Francis Condon	75
Merrimack College, 11024 DOK	Warren Oldaker	Francis Condon	80
New York State Department of Health, Albany, N.Y., 11022 DQI	Richard Keppler	George Kirkpatrick	87
City of Dallas, Texas, 11022 DZU	George Putnicki	George Kirkpatrick	88
City of Akron, Ohio, 11022 DXH	George Harlow	Francis Condon	89
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City of Kenosha, Wisconsin, 11023 EKC	Clifford Risley, Jr.	Francis Condon	93
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CONTRACTS

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Rand Development Corporation, WA 67-2	Robert Feder	William Rosenkranz	40
Rhodes Corporation, 14-12-11	George Putnicki	William Rosenkranz	47
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CONTRACTOR	PROJECT OFFICER	PROJECT MANAGER	PAGE
American Public Works Assoc., 14-12-550	Darwin Wright	Darwin Wright	86
Battelle Memorial Institute, 14-12-519	William Clothier	Francis Condon	92
Roy F. Weston, 14-12-829	Darwin Wright	Darwin Wright	96

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE: Minneapolis-St. Paul Sanitary District, St. Paul, Minnesota

TITLE OF PROJECT: "Dispatching System for Control of Combined Sewer Losses"

PROJECT SITE:	Minneapolis-St. Paul, Minnesota	**DATE AWARDED:**	May 25, 1966
FEDERAL GRANT:	$870,750	**TOTAL EST. PROJ. COST:**	$1,741,500
PROJECT NUMBER:	11022 FAQ	**PPBS NO.**	1102

DESCRIPTION OF PROJECT: Dispatching system for control of combined sewer losses. The project includes preliminary studies to update historic data, a four phase construction project consisting of installation of a gauging system, a data logger, five river monitors, telemetering rain gages, regulator modifications, and a post-construction program evaluation to include special studies by the University of Minnesota. Existing regulators will be replaced with modern power operated gates at 18 key diversion locations. A supervisory system will be provided to telemeter gate positions, flows and levels in sewers to be controlled by the new regulators. This information will be transmitted to a central point where a dispatching operator can observe conditions and regulate flow accordingly. Maximum utilization of interceptor sewer capacity would be assured and overflow to the river will be minimized.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
Washington, D. C. 20242

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE: Springfield Sanitary District

TITLE OF PROJECT: "Evaluation of a Stabilization Pond for Treatment of Combined Sewer Overflows"

PROJECT SITE:	Springfield, Illinois	**DATE AWARDED:**	June 14, 1966
FEDERAL GRANT:	$86,570	**TOTAL EST. PROJ. COST:**	$199,140
PROJECT NUMBER:	3-ILL-1	**PPBS NO.**	1102

DESCRIPTION OF PROJECT: The goal of this project is to determine the effectiveness of a stabilization pond as an overflow treatment device for combined sewage. A twelve-acre stabilization pond will receive the flow by-passed at an existing pumping station during periods of precipitation. This pond will intercept short duration, high intensity rainfalls. The system will provide both temporary storage and treatment of the overflow.

Evaluation of the facility will not only include routine sampling of influent and effluent, but will also include biological sampling of the pond and the receiving stream.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
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INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Rand Development Corporation
Cleveland, Ohio

TITLE OF PROJECT: "Rapid Flow Combustible Filter"

PROJECT SITE: Cleveland, Ohio

FEDERAL CONTRACT: $404,850 *DATE AWARDED:* August 8, 1966

PROJECT NUMBER: WA 67-2
11023 DPI
PPBS NO: 1102

DESCRIPTION OF PROJECT:

This project includes the design, construction, operation and evaluation of a rapid flow combustible filter. This filter, which will utilize combustible materials -- primarily coal, will be installed at a combined sewer overflow in Cleveland, Ohio. Overflowing waste will percolate through a basket containing a relatively shallow bed of coal before discharge. Removal of coarser materials by mechanical filtration is the anticipated result. Upon exhaustion of the filter, the coal-solids mixture will be incinerated.

The investigators, in addition to designing and building the unit, will develop design criteria for future, similar installations. Evaluation of the process will include not only treatment efficiency, but also information on operating costs and procedures. Difficulties encountered in incinerating the coal after use will also be investigated.

INQUIRIES: Contact the

Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

G.N:

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: Metropolitan District Commission
20 Somerset Street
Boston, Massachusetts

TITLE OF PROJECT: "Boston University Bridge Storm Water Detention and Chlorination Station"

PROJECT SITE: Cambridge, Mass.

DATE AWARDED: September 2, 1966

FEDERAL GRANT: $1,000,000

TOTAL EST. PROJ. COST: $4,345,650

PROJECT NUMBER: 11023 FAT

PPBS NO. 1102

DESCRIPTION OF PROJECT:

A detention basin will be constructed to intercept peak flows and to chlorinate waste water, as a means of reducing combined sewage overflows into the Charles River.

The project includes the construction and evaluation of a combined sewer overflow facility, designed to provide a 10-minute minimum sedimentation-detention time with an influent of 233 MGD. The chlorinated effluent will flow by gravity from the detention tanks through a 96 inch outfall pipe into the Charles River. Sludge deposits in the detention tanks will be returned to the sewer system to be treated at the sewage treatment plant. All settled materials will be flushed out of the tanks and into the sewer system after the storm subsides.

INQUIRIES: ***Contact the*** Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
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INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: City of Detroit, Board of Water Commissioners
735 Randolph Street, Detroit, Michigan

TITLE OF PROJECT: "System Monitoring and Remote Control"

PROJECT SITE: Detroit, Michigan

DATE AWARDED: September 14, 1966

FEDERAL GRANT: $1,000,000

TOTAL EST. PROJ. COST: $2,113,000

PROJECT NUMBER: 11022 FAX

PFBS NO. 1102

DESCRIPTION OF PROJECT: Reduction in stream pollution caused by combined sewer overflows by installation of modern control equipment for sewage flows thereby maximizing the use of storage within the existing sewer system. The project consists of installation of new power operated diversionary overflow structures and automatic control instrumentation. The instrumentation includes devices for determination of waste water quality, flow measurement, rainfall data, conduit liquid level sensing, and remote operation of diversion gates. Telemetering will be provided to transmit and record data collected by the instruments and to provide feed back data relative to status of the remote controlled units. Investigations will be made to observe the modifications and additions to the system, to analyze and evaluate the data collected, and to determine the overall effectiveness of the demonstration.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
Washington, D. C. 20242

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: City of Milwaukee, 841 North Broadway, Milwaukee, Wisconsin 53202

TITLE OF PROJECT: "Humbolt Avenue Overflow Detention and Chlorination Facility"

PROJECT SITE: Milwaukee, Wisconsin

DATE AWARDED: October 15, 1966

FEDERAL GRANT: $1,468,589

TOTAL EST. PROJ. COST: $2,368,118

PROJECT NUMBER: 11023 FAU

PPBS NO. 1102

DESCRIPTION OF PROJECT: The project will demonstrate the effectiveness of a detention tank including chlorination facilities for the treatment of combined sewer overflows from a 570 acre urban area. The tank influent will be screened. The tank will be designed to provide a minimum of 15 minutes detention time for sedimentation and chlorination. After an overflow the sludge deposits and remaining wastewater will be pumped to a nearby interceptor sewer for treatment at an existing treatment plant.

Because of the complex nature of the combined sewer system, eight in-system monitoring stations will record flows and sample the overflows.

The overflows presently discharge to the Milwaukee River, seriously impairing most beneficial water uses. Three river monitoring stations will record the dissolved oxygen and temperature, and provide for the collection of river samples to determine the effects of the proposed project on the river water quality.

All data will be analyzed to relate the effectiveness with operation and costs, inclusive of benefits received. Results will be utilized to develop a method for optimizing the design of such facilities and establish relationships to other approaches for achieving comparable results.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
Washington, D. C. 20242

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INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: Sewerage and Water Board of New Orleans, New Orleans, Louisiana

TITLE OF PROJECT: "Chlorination and Hypochlorination of Polluted Storm Water Pumpage"

PROJECT SITE: New Orleans, La. **DATE AWARDED:** December 2, 1966

FEDERAL GRANT: $1,034,250 **TOTAL EST. PROJ. COST:** $1,429,000

PROJECT NUMBER: 11023 FAS **PPBS NO.** 1102

DESCRIPTION OF PROJECT:

To control bacteriological pollution in Lake Pontchartrain the project will demonstrate the effectiveness, efficiency, and economics of using open drainage canals as treatment facilities; the effectiveness of chlorine and hypochlorite disinfection on intermittent high flow discharges; and the optimization of various feeding rates, multiple points of application, and contact time. Facilities for disinfection will be placed and operated in the St. Charles Canal, the London Avenue Canal and the Orleans Avenue Canal. A sodium hypochlorite blending plant will be constructed and a chlorine alarm system installed. The project will include the provision of appropriate instrumentation for the generation of quantitative and qualitative data necessary for a comprehensive evaluation.

INQUIRIES: ***Contact the*** Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
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INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: City of Chippewa Falls, Wisconsin

TITLE OF PROJECT: "Utilization of a Storage Pond with Treatment for Combined Sewer Overflows"

PROJECT SITE: Chippewa Falls, Wis. **DATE AWARDED:** December 23, 1966

FEDERAL GRANT: $289,685 **TOTAL EST. PROJ. COST:** $773,984

PROJECT NUMBER: 11023 FIY **PPBS NO.** 1102

DESCRIPTION OF PROJECT:

Project includes construction of a combined storm water pumping station and storage pond, increased interceptor pumping capacity, increased interceptor pumping conduit, and final settling tank capacity, combined relief sewer and some separation. It will demonstrate the control and elimination of stormwater by passes by diverting to a storage pond for sedimentation with subsequent discharge to the waste water treatment works for both primary and secondary treatment with chlorination. The design, operation procedures, and treatment efficiency will be evaluated. Comparison with separation of storm and sanitary sewers will also be evaluated.

INQUIRIES: *Contact the*

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Federal Water Pollution Control Administration
U.S. Department of the Interior
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INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: East Chicago Sanitary District, East Chicago, Indiana

TITLE OF PROJECT: "East Chicago Treatment Lagoon"

PROJECT SITE: East Chicago, Indiana **DATE AWARDED:** December 23, 1966

FEDERAL GRANT: $1,044,120 **TOTAL EST. PROJ. COST:** $2,179,110

PROJECT NUMBER: 11023 FAV **PPBS NO.** 1102

DESCRIPTION OF PROJECT: Project will evaluate the effectiveness of treating combined sewer overflows in a very deep detention basin having aerobic and anaerobic levels of treatment. The aerobic treatment is accomplished by large oxygen transfer units suspended on surface of basin waters. The prime objective of the project is to demonstrate a control method to optimize the quality of treatment to storm water and combined sewage mixed with industrial waste water. This treatment will render a more acceptable discharge to the recieving waters. The demonstration will assess design criteria for detention basins to provide storage and treatment to storm water and combined sewer overflows; design requirements for large oxygen transfer units in relation to volumes of waste water and quality of effluent.

INQUIRIES: ***Contact the*** Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
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INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Rhodes Corporation
Oklahoma City, Okla.

TITLE OF PROJECT: "Use of a New Technique for Waste Treatment"

PROJECT SITE: Fort Smith, Arkansas

FEDERAL CONTRACT: $317,733 *DATE AWARDED:* December 28, 1966

PROJECT NUMBER: 14-12-11 *PPBS NO:* 1102

DESCRIPTION OF PROJECT:

This project includes the design, construction, operation and evaluation of a prototype high capacity treatment facility designed to handle excessive flows received at a treatment plant during period of storm runoff. The treatment system to be investigated consists of cyclones for removal of coarse solids followed by a high rate dissolved air flotation system for removal of finer solids. Detention in the flotation unit will be less than 10 minutes.

The demonstration unit will be designed to handle 500,000 gallons daily. A portion of the flow at a treatment plant receiving flow from a combined sewerage system is to be diverted through the facility. For purposes of the demonstration, both wet and dry weather flow will be treated. Discreet data will be kept for storm events.

In addition to treatment efficiency of the facility and its components, the investigators will determine design criteria, operating and maintenance problems and costs. Recommendations will include suggestions for use at remote locations.

INQUIRIES: Contact the Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
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INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: Municipality of Metropolitan Seattle
400 West Harrison Street
Seattle, Washington 98119

TITLE OF PROJECT: "Duwamish River--Elliott Bay Storm Water Control System"

PROJECT SITE: Seattle, Washington

DATE AWARDED: December 29, 1966

FEDERAL GRANT: $1,400,000

TOTAL EST. PROJ. COST: $3,891,900

PROJECT NUMBER: 11022 ELK

PPBS NO. 1102

DESCRIPTION OF PROJECT:

A sewerage System Control Scheme designed to regulate and program system flows thru the use of overflow regulators operation-programmed by use of computers. Flows to the waste treatment facilities will be controlled to improve efficiency of plant operation during rainfall periods and to provide selective controlled discharging of storm-water overflow at different points in a manner which will minimize the effect of waste discharges in the receiving waters. Automatic water quality monitors will be utilized as control devices in tirggering discharges to surface water from the regulator stations. Functions of the system for controlling pollution caused by storm water overloading of treatment facilities and sewerage system overflows will be evaluated.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
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Federal Water Pollution Control Administration
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INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: City of Columbus, Ohio

TITLE OF PROJECT: "Modification of Whittier Street Storm Standby Tanks"

PROJECT SITE: Columbus, Ohio

DATE AWARDED: March 30, 1967

FEDERAL GRANT: $300,000

TOTAL EST. PROJ. COST: $1,231,519

PROJECT NUMBER: 11023 FAL

PPBS NO. 1102

DESCRIPTION OF PROJECT:

This project consists of an evaluation of the pollution reduction effectiveness of storm overflow tanks modernized by installation of automated sluice gates and other equipment.

Physical features of the project consist of the renovation of three existing combined sewer overflow tanks having a capacity of 1.3 mg each. The renovation includes automatic controls for the tank influent sluice gates, new travelling bridge type sludge collectors and new pumps. One objective of the automation is to keep sludge levels low by continuously removing it from the tanks and thereby preventing anaerobic decomposition and its resultant odors. Another objective is to control flows at the treatment plant by proper use of the automatically operated sluice gates. The improvements in tank efficiencies are expected to reduce bacterial contamination of the receiving stream, the Scioto River.

Evaluation will include studies of the efficiency of the tanks as treatment units as well as studies of the effect of the system on the river.

INQUIRIES: *Contact the*

Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
Washington, D. C. 20242

GWerdig 1468

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: City of Shelbyville, Illinois

TITLE OF PROJECT: "Systems Approach to Combined Sewer Storm Water Overflow Pollution Abatement"

PROJECT SITE: Shelbyville, Illinois **DATE AWARDED:** March 30, 1967

FEDERAL GRANT: $440,000 **TOTAL EST. PROJ. COST:** $2,295,077

PROJECT NUMBER: 11023 FAM **PPBS NO.** 1102

DESCRIPTION OF PROJECT:

A demonstration of a systems approach to pollution abatement is the goal of this project. The effectiveness of treating combined sewer overflows from small drainage areas in three types of detention and treatment units will be evaluated. These individual units will be coordinated into a total control system for the community.

Units to be installed and evaluated under the grant include:

(1) A storm overflow lagoon, designed for 5-day detention of a 10-year storm, followed by primary and secondary stabilization lagoons will receive flow from 95% of the drainage area.
(2) A storm overflow lagoon designed for 600% of dry weather flow.
(3) A primary storm holding tank for 600% of dry weather flow for 2-hr detention and equipped with a chlorinator, comminutor solids collecting facilities and a lift station to pump sludge to the treatment plant.

INQUIRIES: *Contact the*

Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
Washington, D. C. 20242

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE: City of New York, Department of Public Works
Municipal Building
New York, New York 10007

TITLE OF PROJECT: "Wards Island Water Pollution Control Plant Ponsar Flow Regulating Siphon"

PROJECT SITE: New York City

DATE AWARDED: March 30, 1967

FEDERAL GRANT: $167,250

TOTAL EST. PROJ. COST: $223,000

PROJECT NUMBER: 25-NY-1

PPBS NO. 1102

DESCRIPTION OF PROJECT:

A unique flow regulating device, called the Ponsar Regulator, will be installed and evaluated in the New York Sewerage System. The function of the regulator is to deliver a predetermined maximum volume of combined sewage to the interceptor sewer from the drainage area collector system, with the objective of evening-out the hydraulic load on the sewage treatment plant for increased operating efficiency and to decrease the possibility that, during high flows, inadequately treated sewage would "overflow" the plant and discharge directly into streams. The function and capabilities of the device to contribute to improved sewerage system flow control will be evaluated.

The regulator operates on a siphon principle wherein the flow is proportional to the sum of the hydrostatic and differential pressure heads. The device is constructed so that the total pressure difference will remain constant after a predetermined hydrostatic head has been reached and surpassed.

Also, an adjacent existing conventional regulator will be monitored for direct comparison of performance under similar conditions.

INQUIRIES: ***Contact the*** Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
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GWerdig 102567

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: City of Chicago, Department of Public Works, Chicago, Illinois

TITLE OF PROJECT: "The Lawrence Avenue Underflow Sewer System"

PROJECT SITE: Chicago, Illinois

DATE AWARDED: March 30, 1967

FEDERAL GRANT: $1,500,000

TOTAL EST. PROJ. COST: $20,021,067

PROJECT NUMBER: 11022 EMD

PPBS NO. 1102

DESCRIPTION OF PROJECT: This project will evaluate the effectiveness of employing a deep tunnel system within a highly developed urban area to temporarily store excess combined sewer flows for return to the sewage treatment plant during off-peak hours. This demonstration will reduce the discharge of untreated combined sewage to the receiving stream and minimize overloading the waste treatment plant. Should this method of control prove to be economically feasible through the use of advanced tunneling equipment, present plans in the Chicago Metropolitan Area envisions a vast network of deep tunnels for ultimate control of all waters in excess of that which can be conducted by the existing drainage systems.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
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INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE: Borough of New Providence, New Jersey

TITLE OF PROJECT: "Utilization of High Rate Trickling Filters for Treatment of Combined Sewer Overflows"

PROJECT SITE: New Providence, N.J.

DATE AWARDED: June 16, 1967

FEDERAL GRANT: $474,000

TOTAL EST. PROJ. COST: $1,187,680

PROJECT NUMBER: 11023 FAN

PPBS NO. 1102

DESCRIPTION OF PROJECT:

Two high rate trickling filters will be installed to accommodate and treat the extremely wide range in volume of overflows which occur during periods of rainfall. Overflows are presently discharged untreated to the receiving waters, causing organic and bacterial pollution. Adaptation of this conventional treatment method to adverse operating conditions to achieve treatment of combined sewage prior to discharge will be demonstrated. One trickling filter will be constructed with a plastic filter medium; the other, with conventional trap rock or stone filter medium. Following the filters, facilities will be provided to add polyelectrolytes and other chemicals to improve sedimentation efficiency in the final settling tank, also as a part of this project. Chlorination facilities will disinfect the final effluent.

The facilities will be operated so as to maintain biological growth on the filters during dry weather periods, making the filters effective during periods of overflow. A monitoring program will thoroughly evaluate the operation and effectiveness of the separate treatment units as well as the overall effectiveness of the entire installation. The system operation will be varied so as to develop the most effective and economical plant operation to achieve the desired results.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
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INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Re[illegible]ation Act).

CONTRACTOR: Dow Chemical Company
Midland, Michigan

TITLE OF PROJECT: "Demonstration and Evaluation of Polymeric Additives in the Treatment of Storm Water Overflow"

PROJECT SITE: Detroit, Michigan

FEDERAL CONTRACT: $700,000 **DATE AWARDED:** August 8, 1967

PROJECT NUMBER: 14-12-9
11023 FDB **PPBS NO:** 1102

DESCRIPTION OF PROJECT:

This project involves a two year study of the use of polymeric chemicals to control pollution from combined sewer overflows. The project will be carried out at Milk River Pump Station in suburban Detroit, Michigan. This installation, which serve[illegible]area of about 3700 acres, includes a 3.5 MG detention basin. The project will include complete development of hydrological information for the demonstration area.

Flocculant studies will be carried out on both laboratory and full scale to demonstrate the effect of the use of polymeric flocculants. A demonstration of the effectiveness of disinfectants, both with and without polymers, will be completed on both pilot plant and laboratory scales.

A major part of the project will be the fabrication of a model of the existing basin. This model will be tested concurrently with the full scale basin to validate its use for model extrapolation. An optimized model will be conceived, built and tested as a design for sedimentation basins incorporating chemical flocculation.

INQUIRIES: *Contact the*

Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

G.V:

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Cornell, Howland, Hayes and Merryfield, Engineers and Planners
1600 Western Avenue
Corvallis, Oregon

TITLE OF PROJECT: "Primary Treatment of Storm Water Overflow from Combined Sewers by High Rate Fine Mesh Screens"

PROJECT SITE: Portland, Oregon

FEDERAL CONTRACT: $139,331   DATE AWARDED: August 17, 1967

PROJECT NUMBER: 14-12-121
11023 FDB   PPBS NO: 1102

DESCRIPTION OF PROJECT: This project will include the design, construction, demonstration and evaluation of the performance of high rate, fine mesh vibrating screens for removal of solids from combined sewage.

Various attempts have been made to use vibratory screens in sewage treatment in the past. Grease formation and varying rates of flow were persistent problems. The contractor has several innovations in screen configuration and combinations to be constructed and demonstrated which may reduce these operating difficulties. If the demonstration is successful, the device will be used in normal sewage and at some industrial treatment plants as well as overflow points in combined collection systems.

Development of such devices, which are compact and adaptable, are needed for primary treatment of excess combined sewage under the constraints urban land use and low initial cost.

INQUIRIES: Contact the Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
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GW:

INFORMATION SHEET

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Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Contract, under Section 6a(1), Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR: (Name and Address)
Allis Chalmers
Milwaukee, Wisconsin

PROJECT DIRECTOR: (Name and Address)
Dr. Egbert K. A. Guth
Allis Chalmers
Milwaukee, Wisconsin

TITLE OF PROJECT: "Design, Construction, Operation and Evaluation of a Demonstration Waste Treatment Device Termed the 'Rotating Biological Contactor' "

PROJECT SITE: Milwaukee, Wisconsin

PROGRAM (PROJECT) NUMBER:
14-12-24

DATE OFFERED:

DATE ACCEPTED (AWARDED):
September 28, 1967

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 9/28/67 Thru: 2/28/70	$ 388,526	$ 388,526

DESCRIPTION OF PROJECT:

This project will demonstrate the applicability of a new concept of biological treatment to be applied within the sewage system. The contractor has spent several years in developing a biological treatment method related to trickling filters and activated sludge processes; the method uses power driven rotating disks as the "housing media" for biological growths. Laboratory results have indicated that greatly shortened detention periods can accomplish treatment equivalent, as compared to more conventional methods. This technique offers the potential for biological treatment of flows of greater than normal magnitude, an important factor in treating combined sewer overflows.

INQUIRIES: Contact Project Coordination
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

INFORMATION SHEET

Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Research Contract, under Section 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR: (Name and Address)
Rex Chainbelt, Incorporated
Technical Center
Milwaukee, Wisconsin

PROJECT DIRECTOR: (Name and Address)
Dr. William Katz
Rex Chainbelt, Incorporated Technical Center
Milwaukee, Wisconsin

TITLE OF PROJECT: "Development and Demonstration of Combined Sewage Treatment Utilizing Screening, Chemical Oxidation and Split Flow Air Flotation"

PROJECT SITE: Milwaukee, Wisconsin

PROGRAM (PROJECT) NUMBER:
11023
Contract No. 14-12-40
DATE OFFERED:

DATE ACCEPTED (AWARDED):
October 6, 1967

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 10/6/67 Thru: 6/1/72	$ 355,322	$355,322

DESCRIPTION OF PROJECT:

The originally contracted work was to design, fabricate and demonstrate a system for the treatment of combined sewage using new techniques in chemical oxidation and high rate dissolved air flotation. The project will treat 5 MGD of combined sewage. The dissolved air flotation unit will be operated at recycle rates from 5 to 30 percent of the total flow with 40 to 80 psig. This phase is scheduled for completion July 31, 1970. A final report will be published. A contract modification stipulates additional tasks to be accomplished under their contract. An investigative and demonstration phase on the utilization of sequential screening both above and in conjunction with air flotation will be conducted. The screen size will progress from 1,840 microns to 60 microns. This work will be completed and a final report issued by June 1, 1972.

INQUIRIES: Contact Project Coordination
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE: City of Somersworth, New Hampshire

TITLE OF PROJECT: "Somersworth Combined Sewage Overflow Treatment Project"

PROJECT SITE: Somersworth, N. H.

DATE AWARDED: December 1, 1967

FEDERAL GRANT: $559,080

TOTAL EST. PROJ. COST: $931,800

PROJECT NUMBER: 11023 FAP

PPBS NO. 1102

DESCRIPTION OF PROJECT:

Construction and evaluation of the applicability of two one-million gallon combined sewage treatment and storage tanks. Pollution of receiving waters caused by discharge of untreated combined sewage during wet weather periods will be abated by providing facilities which will accomplish (a) short-term detention chlorination and pump-back to the sewerage system and (b) variable sedimentation times, chlorination, long-term detention and discharge to receiving waters. Effects of treatment on the receiving stream and sewage stabilization pond, technical and economic benefits will be evaluated. Potential benefits of polymers to increase carrying capacity of the interceptor will be explored.

INQUIRIES: ***Contact the*** Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
Washington, D. C. 20242

INFORMATION SHEET – –

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Underwater Storage, Inc.
1028 Connecticut Ave., N.W.
Washington, D.C. 20036

TITLE OF PROJECT: "Pilot Demonstration Underwater Storage Facility for Storm Water Overflow"

PROJECT SITE: Washington, D.C.

FEDERAL CONTRACT: $658,763

DATE AWARDED: December 14, 1967

PROJECT NUMBER: 14-12-139
11022 DWF

PPBS NO: 1102

DESCRIPTION OF PROJECT:

The project includes the design, construction, operation and evaluation and removal of a pilot plant underwater facility for temporary storage of storm overflows from a combined sewer. Pollution of the Anacostia River due to such discharges will be controlled by capturing and temporarily storing the combined sewage in flexible underwater containers until the storm causing overflow has ended.

Storage will be completely under water in two 100,000 gallon containers of flexible rubberized nylon material. These will be anchored to the bed of the Anacostia River. The combined sewage will pass through an automatic bar screen and grinder and through a grit chamber and then flow to the storage containers by gravity. Pumps of a non-clogging type will be used to remove the untreated sewage from the storage containers and return it to the sewerage system for subsequent treatment.

The system will be treated with water pumped from the river during periods when there is no natural storm water overflow.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

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INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Melpar, Inc.
7700 Arlington Boulevard
Falls Church, Virginia

TITLE OF PROJECT: "Pilot Plant for Underwater Storage of Combined Sewer Overflow"

PROJECT SITE: Cambridge, Maryland

FEDERAL CONTRACT: $410,386

DATE AWARDED: December 14, 1968

PROJECT NUMBER: 14-12-133
11022 DPP

PPBS NO: 1102

DESCRIPTION OF PROJECT:

Based on preliminary plans and specifications, the contractor will design, construct, operate and evaluate, and be prepared to remove, a pilot plant underwater facility to provide temporary storage of storm overflows from a combined sewer. Pollution of the Anacostia River due to such discharges will be controlled by capturing and temporarily storing the combined sewage in flexible underwater containers until the storm causing overflow has ended.

Storage will be completely under water in a single container having a maximum capacity of 200,000 gallons. The bottom of the tank will be of vinyl coated steel, placed in a depression excavated in Choptank River. The upper half of the storage container will be of flexible neoprene coated nylon material. Two, two speed (600 - 1,000 gpm) pumps will be used to pump the combined sewage to storage, and to remove the untreated sewage from the storage container and return it to the sewerage system for subsequent treatment.

The system will be tested with fresh water during periods when there is no natural storm water overflow.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

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INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Karl R. Rohrer Associates
529 Grant Street
Akron, Ohio 44311

TITLE OF PROJECT: "Construction of a Facility to Demonstrate Offshore Underwater Temporary Storage of Storm Overflow from a Combined Sewer"

PROJECT SITE: Sandusky, Ohio

FEDERAL CONTRACT: $559,895

DATE AWARDED: December 14, 1967

PROJECT NUMBER: 14-12-143
11022 ECV

PPBS NO: 1102

DESCRIPTION OF PROJECT: A pilot plant underwater facility will be designed, constructed, operated and evaluated as a method of temporarily storing storm overflows from a combined sewer.

Storage will be completely under water in two 100,000-gallon containers of flexible rubber nylon material. These will be attached to a nearly square 24" pipe frame and anchored to the bed of Sandusky Bay of Lake Erie. After passing through a bar screen, the combined sewage will flow by gravity to the storage containers. An 1,800 GPM pump of a non-clogging type will be used to remove the untreated sewage from the storage containers and return it to the sewerage system for subsequent treatment.

Provision will be made for testing the system with fresh water during periods when there is no natural storm water overflow.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: City of New York

TITLE OF PROJECT: "Evaluation of Spring Creek Auxiliary Pollution Control Project"

PROJECT SITE: New York City, New York **DATE AWARDED:** December 26, 1967

FEDERAL GRANT: $843,750 **TOTAL EST. PROJ. COST:** $1,126,000

PROJECT NUMBER: 11023 FAO **PPBS NO.** 1102

DESCRIPTION OF PROJECT:

Overflows from combined sewers contribute significantly to the pollution of Jamaica Bay, New York City in constructing a major combined sewage treatment facility "Spring Creek Auxiliary Pollution Control Project" specifically designed to provide sedimentation and chlorination treatment to combined sewage. The demonstration project will establish pre-construction water quality conditions in Jamaica Bay, Spring Creek area, and location of all sources contributing to pollution of the Bay. Characterization of parameters that measure the effects of combined sewers will be apart of the investigations. Following construction the effectiveness of the combined sewage treatment facilities will be evaluated. It is anticipated that the Spring Creek facility will serve as a prototype for additional projects leading to an upgrading of the quality of Jamaica Bay waters.

INQUIRIES: **Contact the** Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
Washington, D. C. 20242

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INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Glenfield & Kennedy, Inc.
King of Prussia, Pennsylvania

TITLE OF PROJECT: "Microstraining, Ozonization & Chlorination Pilot Tests on Combined Sewer Overflows"

PROJECT SITE: Philadelphia, Pennsylvania

FEDERAL CONTRACT: $180,086

DATE AWARDED: December 27, 1967

PROJECT NUMBER: 14-12-136
11023 EVO

PPBS NO: 1102

DESCRIPTION OF PROJECT: The project will involve the construction, operation, and evaluation of the use of microstrainers for treating combined sewer overflows. Microstrainers are currently used in raw water supply treatment and for polishing sewage treatment plant effluent. The demonstration site will be on part property in the City of Philadelphia, Pa.

The applicability of ozone to disinfect flows will also be evaluated. Improved techniques for disinfection are also desired. Ozone is used fairly extensively in Europe for water supply disinfection, but has had only limited use in this country.

Evaluation of screening and filtration methods is a very important facet of the total Storm/Combined Sewer Program since such treatment has the potential for removing large amounts of organic and inorganic solids contained in the overflows. Such solids are major pollutants during storm periods.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

INFORMATION SHEET — —

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE: City of Mt. Clemens, Michigan

TITLE OF PROJECT: "A Combined Sewerage Collection and Treatment Facility"

PROJECT SITE: Mt. Clemens, Michigan **DATE AWARDED:** February 28, 1968

FEDERAL GRANT: $631,989 **TOTAL EST. PROJ. COST:** $918,500

PROJECT NUMBER: 11023 FAR **PPBS NO.** 1102

DESCRIPTION OF PROJECT:

Overflows from combined sewers cause pollution of the Clinton River during wet-weather periods. The project is designed to demonstrate the feasibility of controlling such pollution by constructing three aerated "Lakelets" to serve as treatment units. The "Lakelets" will be equipped with surface aerators and operated in series. Effluent from the first two ponds will be subjected to chemical treatment and microstraining, with the final effluent from the third pond receiving similar treatment and chlorination prior to discharge to the Clinton River. The project will explore the potential of the Lakelets as recreation facilities for boating and fishing as a part of park operation.

INQUIRIES: ***Contact the*** Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
Washington, D. C. 20242

INFORMATION SHEET--

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: City of Cleveland
City Hall, 601 Lakeside Avenue
Cleveland, Ohio 44114

TITLE OF PROJECT: "A Program for Demonstrating Combined Sewer Overflows Control Techniques for Water Quality Improvement and Beach Protection"

PROJECT SITE: Cleveland, Ohio

DATE AWARDED: May 3, 1968

FEDERAL GRANT: $325,162

TOTAL EST. PROJ. COST: $1,030,000

PROJECT NUMBER: 11023 EZW

PPBS NO. 1102

DESCRIPTION OF PROJECT:

The project consists of the immediate application of several control and treatment methods designed to abate pollution from combined sewer overflows and control of water quality at the Edgewater and White City bathing beaches on Lake Erie in the City of Cleveland. Control and treatment measures to be applied include:

(1) Hypochlorination of combined sewer overflows and local streams contributing to pollution of beach areas.
(2) Use of polymers to reduce overflows by increasing interceptor flow capacity.
(3) Initiation of a sewer flushing program to reduce solids discharged from the drainage area tributary to the Edgewater overflow.
(4) Screening of overflows and streams.
(5) Construction of sheet piling and flexible barriers to enclose beach areas.
(6) Control of water quality within enclosed beach areas.
(7) Collection of debris and coarse solids.
(8) Miscellaneous sewerage system improvements.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
Washington, D. C. 20242

INFORMATION SHEET--

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act(Clean Water Restoration Act).

GRANTEE: City of Dallas
210 City Hall, Main and Harwood
Dallas, Texas 75201

TITLE OF PROJECT: "Stormwater Treatment Facilities"

PROJECT SITE: Dallas, Texas

DATE AWARDED: May 21, 1968

FEDERAL GRANT: $1,093,360

TOTAL EST. PROJ. COST: $1,488,732

PROJECT NUMBER: 11023 FAW

PPBS NO. 1102

DESCRIPTION OF PROJECT:

The project consists of the design, construction and evaluation of a facility to treat overflows from sewers carrying a mixture of domestic wastewater and infiltration stormwater. Physical features include a diversion structure, pumping station, flocculation and sedimentation basins, chemical feed facilities, and a pipeline for conveyance of waste lime sludge from the municipal water treatment plant to the overflow treatment facility.

Treatment Unit #1 will include flocculation, sedimentation and polishing treatment with tube-type clarifiers; Unit #2 will include flocculation and sedimentation; Unit #3 will include high-rate sedimentation. Effluent from the facility will be chlorinated. Design flow rate will be 28 million gallons per day.

The facility will be operated and evaluated as a demonstration project for a period of one year following completion of construction.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
Washington, D. C. 20242

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Aerojet-General Corporation
9200 East Flair Drive
El Monte, California 91734

TITLE OF PROJECT: "Role of Solids in Combined Sewage Pollution"

PROJECT SITE: San Francisco, California

FEDERAL CONTRACT: $92,605.00 *DATE AWARDED:* June 20, 1968

PROJECT NUMBER: 14-12-180 *PPBS NO:* 1102

DESCRIPTION OF PROJECT:

The purpose of the twelve-month field investigation and evaluation is directed toward determination of the feasibility and potential benefits that may be obtained through the removal of solids utilizing in-sewer screening devices. Sufficient data to permit a reasonable assessment of the anticipated removals of floatables and solid material will be obtained. The effect on chlorination requirements resulting from the solids removals will be investigated. The contractor will evaluate the relationship between the aesthetic water quality considerations and proposed State Water Quality Standards for those bodies of water receiving combined sewer overflows.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

G.W:

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: American Process Equipment Corporation
2015 Lisenby Avenue
Panama City, Florida 32401

TITLE OF PROJECT: "Fabrication and Evaluation of an Ultrasonic Filtration System for Treating Combined Sewer Overflows"

PROJECT SITE: Panama City, Florida

FEDERAL CONTRACT: $248,500.00 **DATE AWARDED:** June 25, 1968

PROJECT NUMBER: 14-12-195 **PPBS NO:** 1102
11023 DZF

DESCRIPTION OF PROJECT:

This fourteen month investigation will design, fabricate and demonstrate an ultrasonic filtration system of field size with a maximum capacity of 160 gpm. The potential effectiveness of this system was demonstrated in a three month feasibility study, in which a laboratory unit achieved BOD and Suspended Solids reductions of approximately 65% for a 50 micron element treating raw sewage which had only been subjected to coarse bar screens and a detritor. Ultrasonic energy can restore the filter elements to "like new" condition without necessitating frequent filter element replacements. The testing program would provide definitive quality and quantity data on system performance, reliability and cost. Pretreatment requirements will be determined and automatic operating procedures will be established. Included as a part of this proposal is a one month test program to determine the applicability of the proposed "field unit" for removal of algae from oxidation pond effluents.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

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INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: **Burgess & Niple, Limited**
Consulting Engineers
2015 West Fifth Avenue
Columbus, Ohio 43212

TITLE OF PROJECT: **"Engineering Investigation of Storm and Combined Sewer Pollution at Bucyrus, Ohio"**

PROJECT SITE: Bucyrus, Ohio

FEDERAL CONTRACT: **$136,665.00** *DATE AWARDED:* **June 27, 1968**

PROJECT NUMBER: **14-12-401** *PPBS NO:* **1102**

DESCRIPTION OF PROJECT:

A thirteen (13) month study to investigate the combined sewer problems and evaluate the benefits, economics and feasibility of collection and treatment of overflows in Bucyrus, Ohio. The problems encountered are considered to be typical of combined sewer systems in small communities with flat terrain. Plans will be formulated for solutions of the problems pinpointed during the field investigations. Development of the corrective plans will consider several storage concepts, physical and chemical treatment, partial separation of sewers where appropriate and possible sewage treatment plant modifications.

Field investigations will include monitoring of principal overflow locations, rainfall measurements, and stream gaging.

INQUIRIES: Contact the **Storm and Combined Sewer Pollution Control Branch**
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

GN:

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Henningson, Durham & Richardson
3555 Fornam Street
Omaha, Nebraska 68131

TITLE OF PROJECT: "An Engineering Investigation of Storm and Combined Sewer Problems"

PROJECT SITE: Des Moines, Iowa

FEDERAL CONTRACT: $301,200.00

DATE AWARDED: June 28, 1968

PROJECT NUMBER: 14-12-402
11024 FEJ

PPBS NO: 1102

DESCRIPTION OF PROJECT:

This fifteen month study pertains to engineering investigations necessary to assess combined sewer overflow and stormwater discharge problems in Des Moines, Iowa with the development of recommended applicable solution. Field investigation will be utilized to pinpoint and assess existing problems. Recommended solutions will be selected from a number of alternate approaches based on cost and expected effectiveness in controlling and/or treating the discharges. Alternate solutions to be included are surge or retention basins, percolation basins, mechanical clarification facilities, utilization of flood control facilities and existing open surface channels. Preliminary estimates for sewer separation will be developed.

The contractor will conduct a stream and combined sewer sampling and analysis program, coupled with a rainfall network for development of rainfall-runoff-quality relationships.

INQUIRIES: Contact the Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

G.V:

INFORMATION SHEET

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Aerojet-General Corporation
Environmental Systems Division
El Monte California

TITLE OF PROJECT: "A Method for Assessing the Extent of Pollution from Stormwater Runoff from an Urban Area"

PROJECT SITE: Sacramento, California

FEDERAL CONTRACT: $402,594.00 **DATE AWARDED:** June 29, 1968

PROJECT NUMBER: 14-12-197 **PPBS NO:** 1102

DESCRIPTION OF PROJECT:

This 15 month study will investigate the combined sewer problems in Sacramento, California. Seven potential control and/or treatment systems will be explored to determine applicability as solutions to the problems defined by field investigation. They include: high rate cyclone and air flotation treatment, rapid flow combustible filter, pressure sewers, temporary storage, deep tunnel system, stabilization ponds, and sewer separation. Preliminary plans and specifications will be prepared for each of the systems with a cost/effectiveness evaluation to measure the capability of each system to correct the pollution problems resulting from combined sewer overflows. Economic and social impact studies will be included.

A combined sewer overflow data collection and analysis program, including rainfall-runoff-quality relationships will be established at several locations.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

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INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR:
Metcalf & Eddy, Inc. Engineers
1029 Corporation Way
Palo Alto, California 94303

TITLE OF PROJECT: "Engineering Investigation of the East Bay Municipal Utility District of the San Francisco Bay Area (Oakland)

PROJECT SITE: Oakland, California

FEDERAL CONTRACT: $141,300.00 *DATE AWARDED:* June 29, 1968

PROJECT NUMBER: 14-12-407
11024 EQG
PPBS NO: 1102

DESCRIPTION OF PROJECT:

A fifteen (15) month study to conduct an engineering investigation of sewer infiltration problems in the East Bay Municipal Utility District of the San Francisco Bay Area (Oakland). At the present time, (due to infiltration) the sanitary sewage system functions as a combined storm-sanitary system during wet weather. Sewage treatment plant flows rise to 5 times dry weather flow resulting in a great deal of by-passing. Problem areas and causes will be delineated and alternative engineering solutions will be developed, including determination of both technical and economic feasibility. Generalized cost curves will be developed for the alternates. Applicability of solutions to other areas with similar problems will be considered.

A representative data collection program will be conducted. Approximately twenty flow gaging stations, five sampling sites and a rain gage network will be utilized.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

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INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: R. F. Weston
Environmental Science & Engineering Consultants
1426 Lewis Lane
West Chester, Pennsylvania 19380

TITLE OF PROJECT: "Develop and Demonstrate a Method for Assessing the Extent of Pollution from Storm Water Runoff in an Urban Area"

PROJECT SITE: Washington, D. C.

FEDERAL CONTRACT: $229,525 *DATE AWARDED:* June 29, 1968

PROJECT NUMBER: 14-12-403
11024 EXF *PPBS NO:* 1102

DESCRIPTION OF PROJECT:

Roy F. Weston will conduct a twelve month study to investigate the combined sewer problems in the District of Columbia. Twenty-five square miles served by combined sewers would be included in the project area. Several alternate approaches to solution of the overflow problem will be investigated, with emphasis on chemical flocculation coupled with high-rate filtration. The "deep tunnel" storage concept will also be considered.

The Contractor will gage major streams and major overflows within the demonstration area, in conjunction with a overflow quality sampling and analysis program at selected locations.

A laboratory research program will be conducted to determine the efficiency of removing flocculated solids and associated BOD by high rate filtration of combined sewer overflows. Filtration rates of 15 or more gallons per minute per square foot are anticipated.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE: City and County of San Francisco
Public Works Department, 260 City Hall
San Francisco, California 94102

TITLE OF PROJECT: "Treatment of Combined Sewer Overflows by the Dissolved Air Flotation Process"

PROJECT SITE: San Francisco, Calif. **DATE AWARDED:** July 24, 1968

FEDERAL GRANT: $921,000 **TOTAL EST. PROJ. COST:** $1,463,000

PROJECT NUMBER: 11023 DXC **PPBS NO.** 1102

DESCRIPTION OF PROJECT:

The project consists of the design, construction and evaluation of a combined sewer overflow treatment facility at the Baker Street Outfall consisting of trash racks, short-term sedimentation for removal of settleable solids, dissolved air flotation for removal of particulate and liquid floatables and disinfection utilizing chlorine.

Conditions of the receiving waters will be thoroughly investigated prior to placing the facility in operation and the cost/effectiveness of the treatment facility evaluated following construction.

The character of combined sewage in the drainage area tributary to the Baker Street Outfall will be defined and the applicability of the treatment process to other outfalls in the San Francisco sewerage system assessed.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
[redacted]
Washington, D. C. 20242

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE: Board of County Commissioners
Montgomery County, Ohio

TITLE OF PROJECT: "The Determination of Ground Water Infiltration and the Effects of Internal Chemical Sealing of Sanitary Sewers"

PROJECT SITE: Kettering, Ohio

DATE AWARDED: August 8, 1968

FEDERAL GRANT: $96,570

TOTAL EST. PROJ. COST: $137,000

PROJECT NUMBER: 11022 DHQ

PPBS NO. 1102

DESCRIPTION OF PROJECT:

A demonstration program is to be carried out which will precisely identify the cause and degree of infiltration of surface and ground water into selected sewer sections. After establishing the cause and affects of this surcharging remedial action will be taken utilizing internal sewer sealing with chemicals and pressure grouting. New techniques for ehcmical application will be developed as the work progresses. After and during the sealing program effectiveness and cost data will be analyzed to establish the most effective technique and material with respect to solution of the problem and cost.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
[illegible]
Washington, D. C. 20242

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Hayes, Seay, Mattern and Mattern
Roanoke, Virginia

TITLE OF PROJECT: "Engineering Investigation of Combined Sewer Overflow Problem"

PROJECT SITE: Roanoke, Virginia

FEDERAL CONTRACT: $104,191

DATE AWARDED: August 16, 1968

PROJECT NUMBER: 14-12-200
11024 DMS

PPBS NO: 1102

DESCRIPTION OF PROJECT: A twelve (12) month study to investigate overloaded sewer problems in Roanoke, Virginia. Storm waters enter the sanitary sewer system causing overloading of both the collection system and the sewage treatment facilities. By-passes enter the Roanoke River and reach Smith Mountain Lake, a hydro-electric power development which is also used extensively for water-oriented recreation. The overflow problems of the area will be subjected to a detailed engineering evaluation. Preliminary plans with cost estimates for remedial measures will be prepared.

INQUIRIES: Contact the Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
~~633 Indiana Avenue, N.W.~~
Washington, D. C. 20242

GW:

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: American Public Works Association
1313 East 60th Street
Chicago, Illinois

TITLE OF PROJECT: "Analysis of Regulator Facilities, Their Application and Maintenance Practices"

PROJECT SITE: Chicago, Illinois

FEDERAL CONTRACT: $65,000

DATE AWARDED: August 30, 1968

PROJECT NUMBER: 14-12-456
11022 DMU

PPBS NO: 1102

DESCRIPTION OF PROJECT:

A seventeen month analysis of combined sewer overflow regulator facilities to determine what improvements are needed to increase the efficacy, resulting in reduced pollution. The final report will serve as a community working guide as it will establish the state of the art by (1) providing practical and useful information concerning design criteria and operational and maintenance practices, (2) stressing the application of newly developed or improved materials and technology presently available, and (3) identifying areas for future research and development. The APWA Research Foundation will finance up to 25% of the total cost through financial participation by public agencies such as cities and counties at the local level.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
[illegible]
Washington, D. C. 20242

G/I:

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6,(a2) Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Black, Crow & Eidsness
1261 Spring Street, N.W.
Atlanta, Georgia 30309

TITLE OF PROJECT: "An Engineering Investigation of Combined Sewer Problems of Atlanta, Georgia"

PROJECT SITE: Atlanta, Georgia

FEDERAL CONTRACT: $263,826

DATE AWARDED: September 5, 1968

PROJECT NUMBER: 14-12-458
11024 ELB

PPBS NO: 1102

DESCRIPTION OF PROJECT:

A detailed engineering investigation and comprehensive technical study will be carried out in the South River Drainage Basin of Atlanta, Georgia to: (1) evaluate the benefits, economics and feasibility of alternate schemes including separation, collection, storage and treatment for overflow or bypassed waste water from combined sewer systems, and the discharges of storm water collection systems, (2) correlate pollution load data with type of zoning and detailed land use and (3) develop methodology to relate storm water drainage in both quality and quantity to zoning classification.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
~~XXXXXXXXXXXXXXXXXXXXX~~.
Washington, D. C. 20242

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act [Clean Water Restoration Act].

CONTRACTOR: FMC Corporation
Central Engineering Laboratories
1185 Coleman Avenue
Santa Clara, California 95052

TITLE OF PROJECT: "Evaluation of a Periodic Flushing System for Combined Sewer Cleaning"

PROJECT SITE: Santa Clara, California

FEDERAL CONTRACT: $323,600

DATE AWARDED: October 9, 1968

PROJECT NUMBER: 14-12-466
11022 DNO

PPBS NO: 1102

DESCRIPTION OF PROJECT:

The objective of this 13-month project is to perform Phase II of a three-phase program to demonstrate the feasibility of reducing pollution from combined sewer storm overflows by means of periodic flushing during dry weather. Included in the total program are study of the theoretical basis for correlating flushing requirements for various sewer conditions, verification of the hydraulic requirements for flushing by test, and installation and systematic operation of flushing equipment in a significant area of an actual combined sewer system.

The test equipment to be built in Phase II consists of 12" and 18" diameter test sewers about 800 feet long, supported above ground so the slope can be adjusted. Flush tanks will be provided at three points along the test sewers.

Based on extensive tests with this facility, system design procedures and criteria for application of sewer flushing systems will be determined. Flushing equipment for use in an actual field environment will be designed and built.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
[redacted].
Washington, D. C. 20242

GN:

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 5, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE: Merrimack College
Turnpike Road
North Andover, Massachusetts 01845

TITLE OF PROJECT: "Controlling Pollution from Combined Sewer Overflows and Storm Water by Electrode Potential"

PROJECT SITE: North Andover, Mass. **DATE AWARDED:** December 22, 1968

FEDERAL GRANT: $21.563 **TOTAL EST. PROJ. COST:** $45,413

PROJECT NUMBER: 11024 DOK **PPBS NO.** 1102

DESCRIPTION OF PROJECT:

To investigate and demonstrate at the laboratory level the feasibility of utilizing electrode potential measuring systems to indicate the strength of combined sewage. A secondary objective of this demonstration will be determining the feasibility of the incorpation of such an electrolytic circuit in a control scheme to regulate the flow of combined or other sewage by mechanical means.

INQUIRIES: *Contact the*

Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
[illegible]
Washington, D. C. 20242

INFORMATION SHEET - - -

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R & D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Ionics Incorporated
65 Grove Street
Watertown, Massachusetts 02172

TITLE OF PROJECT: Feasibility of High Current Density Hypochlorite Generation

PROJECT SITE: Watertown, Mass.
DATE AWARDED: Feb. 19, 1969

FEDERAL CONTRACT: 14-12-490
TOTAL PROJ. COST: $74,646.00

PROJECT NUMBER: 11023 DAA
PPBS NO: 1102

BRANCH CHIEF: William Rosenkranz, Chief
Storm & Combined Sewer Pollution Control Br.
PROJECT OFFICER: Allyn Richardson
Northeast Region

DESCRIPTION OF PROJECT:

Ionics, Inc. will conduct a one year study to determine the feasibility and economics of operation of a high current density (400-500 A/SF) hypochlorite generator for utilization in the treatment of combined sewer overflows and/or storm sewer discharges. If technical and economical feasibility is determined, the contractor will prepare a prototype design in sufficient detail to permit fabrication and field testing of a full-scale device. The prototype design shall be modular in nature and compatible with current hypochlorite feeding devices. Over-all operation and maintenance costs shall be developed. A operation and maintenance manual will be provided.

INQUIRIES: Contact the
Storm & Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
Washington, D.C. 20242

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Water Resources Engineers, Inc.
1900 Olympic Boulevard
Walnut Creek, California 94596

TITLE OF PROJECT: TRIUMVIRATE, Storm Water Pollution Control Management

PROJECT SITE: Walnut Creek, California

FEDERAL CONTRACT: $114,860 *DATE AWARDED:* March 4, 1969

PROJECT NUMBER: 14-12-501 (11024EBI) *PPBS NO:* 1102

DESCRIPTION OF PROJECT: An eighteen (18) month program to develop a comprehensive mathematical model capable of representing urban storm water runoff phenomena, both quantity and quality, from the onset of precipitation on the basin, through collection, conveyance, storage, and treatment systems, to points downstream from outfalls which are significantly affected by storm discharges. The validity of the model for simulating existing situations will be demonstrated by applying it to several storm and combined sewer drainage basins: (1) Storm sewers: 1 large and 1 small basin; (2) Combined sewers: 1 large and 1 small basin.

Development of the model is scheduled for twelve months and demonstration is for a period of six (6) months.

The Triumvirate of University of Florida, Water Resources Engineers, Inc., and Metcalf and Eddy, Inc. have joined together (under the overall coordination of Metcalf and Eddy, Inc.) to develop this working tool to assist municipalities in the management and control for storm water pollution abatement. Total project cost is $513,650.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

G.I:

INFORMATION SHEET — —

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: Metcalf and Eddy, Inc.
1029 Corporation Way
Palo Alto, California 94303

TITLE OF PROJECT: TRIUMVIRATE, Storm Water Pollution Control Management

PROJECT SITE: Palo Alto, California

FEDERAL CONTRACT: $253,800 DATE AWARDED: March 4, 1969

PROJECT NUMBER: 14-12-502 (11024DOC) PPBS NO: 1102

DESCRIPTION OF PROJECT: An eighteen (18) month program to develop a comprehensive mathematical model capable of representing urban storm water runoff phenomena, both quantity and quality, from the onset of precipitation on the basin, through collection, conveyance, storage, and treatment systems, to points downstream from outfalls which are significantly affected by storm discharges. The validity of the model for simulating existing situations will be demonstrated by applying it to several storm and combined sewer drainage basins: (1) Storm sewers: 1 large and 1 small basin; (2) Combined sewers: 1 large and 1 small basin.

Development of the model is scheduled for twelve months and demonstration is for a period of six (6) months.

The Triumvirate of University of Florida, Water Resources Engineers, Inc. and Metcalf and Eddy, Inc. have joined together (under the overall coordination of Metcalf and Eddy, Inc.) to develop this working tool to assist municipalities in the management and control for storm water pollution abatement. Total project cost is $513,650.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

G/:

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: University of Florida
Department of Environmental Engineering
Gainesville, Florida 32601

TITLE OF PROJECT: TRIUMVIRATE, Storm Water Pollution Control Management

PROJECT SITE: Gainesville, Florida

FEDERAL CONTRACT: $144,990 **DATE AWARDED:** March 11, 1969

PROJECT NUMBER: 14-12-503 (11024EBJ) **PPBS NO:** 1102

DESCRIPTION OF PROJECT: An eighteen (18) month program to develop a comprehensive matehmatical model capable of representing urban storm water runoff phenomena, both quantity and quality, from the onset of precipitation on the basin, through collection, conveyance, storage, and treatment systems, to points downstream from outfalls which are significantly affected by storm discharges. The validity of the model for simulating existing situations will be demonstrated by applying it to several storm and combined sewer drainage basins: (1) Storm sewers: 1 large and 1 small basin; (2) Combined sewers: 1 large and 1 small basin.

Development of the model is scheduled for twelve months and demonstration is for a period of six (6) months.

The Triumvirate of University of Florida, Water Resources Engineers, Inc. and Metcalf and Eddy, Inc. have joined together (under the overall coordination of Metcalf and Eddy, Inc.) to develop this working tool to assist municipalities in the management and control for storm water pollution abatement. Total project cost is $513,650.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

G.W:

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act [Clean Water Restoration Act).

CONTRACTOR: American Standard Incorporated
P.O. Box 2003
New Brunswick, New Jersey

TITLE OF PROJECT: "Develop a Suspended Solids Monitor"

PROJECT SITE: New Brunswick, New Jersey

FEDERAL CONTRACT: $121,946 **DATE AWARDED:** March 28, 1969

PROJECT NUMBER: 14-12-494
11024 DZB **PPBS NO:** 1102

DESCRIPTION OF PROJECT:

A suspended solids monitor for use in continuously measuring suspended solids in sewage will be developed and evaluated. A new principal for such measurement, based on the measurement of light depolarization, will be utilized. Phase I of the project will determine feasibility of the technique, Phase II will accomplish design of the prototype instrument, Phase III will involve selection and bench-scale testing of optical components, and electronic components will be selected in Phase IV. Phase V will consist of field standardization and calibration of the prototype in a sewage environment.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

C.J:

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: American Public Works Association-Research Foundation
1313 East 60th Street
Chicago, Illinois 60637

TITLE OF PROJECT: "Causes, Extent and Control of Infiltration"

PROJECT SITE: Chicago, Illinois

FEDERAL CONTRACT: $89,780 DATE AWARDED: May 23, 1969

PROJECT NUMBER: 14-12-550
11022 EFF PPBS NO: 1102

DESCRIPTION OF PROJECT:

A 15 month study of the causes and control of storm and ground water infiltration into sanitary and combined sewers -- including investigation of sewer design, construction, testing and inspection, and grouting practices. Specific objectives include: (1) catalog the extent and causes, (2) delineate the relative importance of various sources, (3) investigate present design criteria and practices, (4) review present construction, testing and inspection practices and techniques, (5) investigate present infiltration detection, leak location and grouting techniques and practices, (6) identify future research, development and demonstration needs and (7) prepare a "Manual of Recommended Practice".

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

GA:

INFORMATION SHEET

Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Demonstration Grant, under Section 6a1, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR: (Name and Address)
New York State Department of Health
84 Holland Avenue
Albany, New York 12208

PROJECT DIRECTOR: (Name and Address)
Leo J. Hetling
(Address same as above)

TITLE OF PROJECT: "A Pressure Sewer System Demonstration"

PROJECT SITE: Albany, New York

PROGRAM (PROJECT) NUMBER:
11022DQI

DATE OFFERED:
March 24, 1969

DATE ACCEPTED (AWARDED):
April 16, 1969

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 4/16/69 Thru: 12/70	$ 311,800	$ 200,800

DESCRIPTION OF PROJECT:

The New York State Department of Health proposes a 21 month investigation to install, demonstrate and evaluate a pressure sewer system which could be utilized to separate sanitary sewage from combined sanitary sewage and storm water. A pilot-scale system will be designed to serve 11-12 houses in a redevelopment area in Albany, New York, presently served by combined sewers. Prototype pump-grinder units developed by the General Electric Company as a part of the ASCE Contract (14-12-29) would be utilized to convey sewage from the home to the pressure sewer in the street.

Four principal objectives are incorporated in the project: (1) monitoring, evaluation of the prototype pump-grinder units to determine reliability and need for modification or redesign. (2) test durability of the units operating singly and in concern (manifolded to common pressure sewer). (3) provide proof of the field suitability of the assemblage, which should be considered a module of a larger pressure system. (4) provide new data which would be invaluable in subsequent pressure system applications.

Four principal investigating entities would be involved in conducting the project, each with assigned responsibilities: New York State Department of Health, New York State Pure Waters Authority, American Society of Civil Engineers and the

INQUIRIES: Contact Project Coordination Environmental Technology, Inc.
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

INFORMATION SHEET

April 30, 1969
Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Demonstration Grant under Section 6a1, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR: (Name and Address)
City of Dallas
500 South Ervay Street
Dallas, Texas 75201

PROJECT DIRECTOR: (Name and Address) A. E. Holcomb

TITLE OF PROJECT: "Use of Polymers to Reduce or Eliminate Sewer Overflow in the Bachman Creek Sewer"

PROJECT SITE: Dallas, Texas

PROGRAM (PROJECT) NUMBER.
11022DZU

DATE OFFERED:
April 23, 1969

DATE ACCEPTED (AWARDED):
May 23, 1969

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 5/23/69 Thru: 6/23/71	$ 441,647	$ 331,233

DESCRIPTION OF PROJECT:

The project consists of the design, construction and evaluation of a permanent polymer injection station on the Bachman Creek Sewer in Dallas, Texas. The project will further demonstrate and evaluate a technique developed earlier for FWPCA by contract which utilizes injection of polymers into a sewer for the purpose of increasing the carrying capacity of the pipe.

During periods of wet weather the Bachman Creek sewer receives excess quantities of ground or storm water due to infiltration. The flow then exceeds its carrying capacity and untreated wastes overflow in at least 10 locations, causing pollution of Bachman Creek. The project will seek to eliminate or greatly reduce the number and volume of untreated overflows by increasing the flow capacity of the Bachman Creek Sewer through the addition of polymers. Design criteria, operating techniques, optimum polymer concentration and other pertinent data critical to the intended use will be evaluated.

INQUIRIES: Contact Project Coordination
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

INFORMATION SHEET

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Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Grant, under Section 6a1 Demonstration, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR: (Name and Address)
City of Akron
166 South High Street
Akron, Ohio 44308

PROJECT DIRECTOR: (Name and Address)
C. E. Susong
City Engineer
166 South High Street
Akron, Ohio 44308

TITLE OF PROJECT: "Demonstration of Void Space Storage with Treatment and Flow Regulation"

PROJECT SITE: Akron, Ohio

PROGRAM (PROJECT) NUMBER:
11020DXH

DATE OFFERED:
April 24, 1969

DATE ACCEPTED (AWARDED):
May 23, 1969

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 5/23/69 Thru: 5/23/72	$ 750,000	$ 562,500

DESCRIPTION OF PROJECT:

The project is to construct, operate and evaluate an underground storage/treatment facility for excess combined sewage. The facility will include novel concepts in construction and operation. It will be an excavated hopper shaped cavity, lined with an impermeable membrane, filled with an inert material covered with soil and the surface made useable. Storage will be in the void space of the fill. The flow regulation of influent will be a new and improved device, probably a fluidic regulator. The sewage will be pre-treated prior to entry to the storage facility. Tube clarifiers will be utilized to compare results with an on-going project where these units are being used for the first time at an operational level on combined sewage.

INQUIRIES: Contact Project Coordination
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

INFORMATION SHEET

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Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Research Grant, under Section 5a2, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR: (Name and Address) University of Cincinnati
Cincinnati, Ohio 45221

PROJECT DIRECTOR: (Name and Address) Herbert C. Preul, Ph.D., Dept. of Civil Engineering
University of Cincinnati, Cincinnati, Ohio 45221

TITLE OF PROJECT: "Urban Runoff Characteristics"

PROJECT SITE: Cincinnati, Ohio

PROGRAM (PROJECT) NUMBER:
11024DQU

DATE OFFERED:
May 28, 1969

DATE ACCEPTED (AWARDED):
June 23, 1969

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 6/23/69 Thru: 6/23/70	$ 55,690	$ 52,905 (first year)

DESCRIPTION OF PROJECT:

The intent of this first year of a proposed three year research project is to collect, for the first time, detailed information defining the physical characteristics of an urban drainage area tributary to a combined sewer drainage system and detailed data relating to the quantity and quality of various sources of pollution within the combined sewer drainage area. Generally in the past, data have been collected only at the actual overflow location from a drainage area. The collection and evaluation of data from within the tributary drainage area will provide valuable insights regarding methods for controlling the strength and volume of combined sewer overflows.

A comprehensive storm water management mathematical model is presently under development for predicting the quantity and quality of combined sewer overflows. The detailed data collected will be utilized for verification and utilization of this model by communities needing a working tool for development of combined sewer overflow abatement programs.

INQUIRIES: Contact Project Coordination
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

INFORMATION SHEET

Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Research Grant, under Section 5a(2), Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR: (Name and Address)
Lehigh University
Bethlehem, Pennsylvania 18015

PROJECT DIRECTOR: (Name and Address)
W. H. Graf, Associate Professor of Civil Engineering
Lehigh University
Bethlehem, Pennsylvania 18015

TITLE OF PROJECT: "Transport of Solid Suspension in Conduits"

PROJECT SITE: Bethlehem, Pennsylvania

PROGRAM (PROJECT) NUMBER:
11024 EKD

DATE OFFERED:
June 12, 1969

DATE ACCEPTED (AWARDED):
June 19, 1969

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 7/1/69 Thru: 6/30/70	$ 41,095 (1969-70)	$ 37,000

DESCRIPTION OF PROJECT:

The objectives of this two-part project are:

1. To continue the investigation and determination of design criteria for minimum transport velocities of non-depositing solid-liquid mixtures in pipe lines.
2. To further develop a modified Venturi meter to measure mixture flow rate and concentration simultaneously.

The benefits would include improved design and operation of pressure lines for the transport of ground sanitary sewage. Such pressure lines would be used for combined sewer separation and control of overflows of combined sewage to streams, as developed by the combined sewer separation project of the American Society of Civil Engineers (FWPCA contract no. 14-12-29).

INQUIRIES: Contact Project Coordination
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

INFORMATION SHEET

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Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Contract, under Section 6al, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR: (Name and Address)
Battelle Memorial Institute
Pacific Northwest Laboratory
P.O. Box 999
Richland, Washington 99352

PROJECT DIRECTOR: (Name and Address)
Allen J. Shuckrow
Pacific Northwest Laboratory
Battelle Memorial Institute
Richland, Washington 99352

TITLE OF PROJECT: "Development, Demonstration and Evaluation of Physical-Chemical Treatment of Combined Storm-Sanitary Sewage"

PROJECT SITE: Richland, Washington, and selected field sites

PROGRAM (PROJECT) NUMBER:
14-12-519
11023 DSQ

DATE OFFERED:

DATE ACCEPTED (AWARDED):
June 23, 1969

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 6/23/69 Thru: 12/23/72	$ 391,310	$391,310

DESCRIPTION OF PROJECT:

The project is a two and one-half year development, demonstration and evaluation of the applicability, effectiveness and economics of a physical-chemical method of treating combined sewage. The basic process to be demonstrated utilizes powdered activated carbon adsorption, inorganic coagulation, polyelectrolyte flocculation, sedimentation and spent carbon regeneration.

Treatment units and process methodology will be specifically designed to meet the constraints of high and widely fluctuating wastewater volumes, widely varying wastewater quality, short detention times, intermittant use, low first cost and economics of operation, and small construction sites. Beginning with bench-scale design experiments the process will be carried thru pilot-scale operations and detailed evaluation of the method.

INQUIRIES: Contact Project Coordination
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

INFORMATION SHEET

Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Demonstration Grant under Section 6a1, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR:
(Name and Address)
City of Kenosha
100-51st Place
Kenosha, Wisconsin
Mr. O. Fred Nelson

PROJECT DIRECTOR:
(Name and Address)
Rex-Chainbelt Technical Center
5101 West Beloit Road
West Milwaukee, Wisconsin 53214

TITLE OF PROJECT: "Demonstration Project of Biological Absorption of Pollutants from Combined Storm Water Runoff and Sanitary Sewage"

PROJECT SITE: Kenosha, Wisconsin

PROGRAM (PROJECT) NUMBER: 11023EKC

DATE OFFERED: July 23, 1969

DATE ACCEPTED (AWARDED):
September 5, 1969

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 9/10/69 Thru: 6/10/72	$ 730,000	$547500

DESCRIPTION OF PROJECT:

The project objective is to provide a means for high rate biological treatment of combined sewage by the utilization of viable, activated sludge, clarification and disinfection. The method will be to store sludge in a biosolids reservoir and maintain a contact tank and solids stabilization tank in an empty and ready condition at the sewage treatment plant.

When a rain event occurs the excess combined sewage will be directed to the contact tank and the activated sludge proportionally introduced. The tank will be designed to have 15-30 min contact time. From the contact tank the flow will be directed to a clarifier for solids separation. The effluent will be disinfected and discharged to Lake Michigan with solids returned to the solids stabilization tank and reused or wasted to the digesters.

INQUIRIES: Contact Project Coordination
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

INFORMATION SHEET

Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Demonstration Grant under Section 5, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR: (Name and Address)
Tulane University
New Orleans, Louisiana 70118

PROJECT DIRECTOR: (Name and Address)
Dr. Frank W. Macdonald
Professor of Civil Engineering & Public Health
Tulane University

TITLE OF PROJECT: "Bedding and Infiltration Studies of Sanitary Sewers in the Gulf Cost Area"

PROJECT SITE: New Orleans, Louisiana

PROGRAM (PROJECT) NUMBER:
11022 DEI

DATE OFFERED:
August 25, 1969

DATE ACCEPTED (AWARDED):
September 18, 1969

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 9/18/69 Thru: 2/14/71	$ 31,385	$ 23,538

DESCRIPTION OF PROJECT:

This is a continuation grant for the fifth and final year of a Demonstration grant. The objectives are to determine the best type of bedding arrangements and the most suitable materials to be used in laying sewer pipes in the Gulf Coast Area. Investigations will also be conducted on the performance of manholes, tees and other appurtenances. Infiltration studies will continue of three in-use sections of sewer lines. This final year will be used in filling voids in the needed data, and the preparation of the final report which will contain a "Manual" section of recommended materials and practices.

INQUIRIES: Contact Project Coordination
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

INFORMATION SHEET

Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Demonstration Grant, under Section 6a(1), Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR: (Name and Address)
City of Rohnert Park, California
435 Southwest Boulevard
Rohnert Park, California 94928

PROJECT DIRECTOR: (Name and Address)
John A. Voegtle, P.E.
Yoder/Orlob Associates
1900 Olympic Boulevard
Walnut Creek, California 94596

TITLE OF PROJECT: "Treatment of Peak Wet Weather Wastewater Flows, and Rate Control of All Wastewater Discharges to Interceptor Sewers"

PROJECT SITE: Rohnert Park, California

PROGRAM (PROJECT) NUMBER:
11023 DSX

DATE OFFERED:
September 18, 1969

DATE ACCEPTED (AWARDED):
October 10, 1969

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 10/10/69 Thru: 7/10/72	$ 401,300	$299,500

DESCRIPTION OF PROJECT:

Inflow of storm water to the City of Rohnert Park sanitary sewer system causes peak wet weather flow of up to 10 times the average dry weather flow. As a result, the treatment plant becomes ineffective for a period of several weeks.

A new combined sedimentation and flow equalization pond would be constructed to include an unique sludge collection system for use during wet weather and an aerator for dry weather use only. All excess wet weather overflow from this pond would be delivered to a storage and chlorination pond (the existing oxidation pond), and would be released to the receiving stream after about two days detention and chlorine contact. Dry weather flow and solids collected in the equalization pond would underflow to the existing primary sedimentation basin and sludge digester. Achievement of a nearly constant underflow would serve to demonstrate its effect on operation of the existing facility, and to demonstrate the feasibility of designing a less costly interceptor sewer for later transport of the underflow to a Regional treatment plant. Extension of this system to other plants in the area could serve to reduce the cost of a Regional plant.

INQUIRIES: Contact Project Coordination
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

INFORMATION SHEET

Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Contract, under Section 6a(1), Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR: (Name and Address)
Roy F. Weston
Environmental Scientists and Engineers
Lewis Lane
West Chester, Pennsylvania 19380

PROJECT DIRECTOR: (Name and Address)
Micheal Neijna
Roy F. Weston
Lewis Lane
West Chester, Pennsylvania 19380

TITLE OF PROJECT: "Kingman Lake Recreational Area - Phase One Engineering Investigation"

PROJECT SITE: Washington, D.C.

PROGRAM (PROJECT) NUMBER:
11023 FIX
Contract No. 14-12-829

DATE OFFERED:

DATE ACCEPTED (AWARDED):
December 29, 1969

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 12/69 Thru: 4 or 5/70 (21 weeks)	$ 137,750	$ 137,750

DESCRIPTION OF PROJECT:

This 21 week, $137,750 project will be an engineering investigation to develop design parameters and preliminary costs for the design of a combined sewer overflow treatment facility, including soils information necessary for construction. Basic quality and quantity information on the combined sewer overflows from the Northeast Boundary Trunk sewer, Washington, D.C., will be defined. Overflows from this outfall will be treated and used for recreational purposes in the Kingman Lake Recreational Area.

INQUIRIES: Contact Project Coordination
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

b. Storm Water Discharges

GRANTS

GRANTEE	PROJECT OFFICER	PROJECT MANAGER	PAGE
City of South St. Paul, Minn., 11031 DSL	Clarence Oster	George Kirkpatrick	99
City of LaSalle, Ill., 11032 DTI	Clifford Risley, Jr.	Francis Condon	100

CONTRACTS

CONTRACTOR	PROJECT OFFICER	PROJECT MANAGER	PAGE
AVCO - Economic Systems Corp., 14-12-187	George Putnicki	Darwin Wright	98

INFORMATION SHEET --

RESEARCH & DEVELOPMENT CONTRACT

This sheet describes briefly an R&D Contract awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

CONTRACTOR: AVCO-Economic Systems Corporation
1701 K Street, N. W.
Washington, D. C. 20006

TITLE OF PROJECT: "Develop the Relation between Land-Use Practices and Influence of Pollution in Urban Storm Water"

PROJECT SITE: Tulsa, Oklahoma

FEDERAL CONTRACT: $114,300.00 **DATE AWARDED:** June 13, 1968

PROJECT NUMBER: 14-12-187 **PPBS NO:** 1103

DESCRIPTION OF PROJECT:

AVCO proposes to develop the relationship between land-use practices and incidence of pollution in urban stormwater runoff. Means of analyzing and evaluating the extent and degree of pollution resulting from urban areas of varying land-use patterns will be developed utilizing Tulsa, Oklahoma as the subject area. Based on the findings of field investigations, a recommended program for corrective measures emphasizing regulatory controls of the area, such as improved urban planning, zoning and regulations of land-use will be developed.

During the 18 month study, AVCO will monitor the storm water runoff from fifteen sampling sites. The data will be stored in STORET and subsequently used in the mathematical model along with the land-use data. An IBM Sytem /360 will be used for the mathematical model for pollution incidence determinations. Mathematical relationships will make use of a regression technique and principal component analysis.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N.W.
Washington, D. C. 20242

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE: City of South St. Paul, Minnesota

TITLE OF PROJECT: Demonstration Project for Temporary Detention of Storm and Combined Sewage in Natural Underground Formations

PROJECT SITE: South St. Paul, Minn. **DATE AWARDED:** July 22, 1968

FEDERAL GRANT: $385,000 **TOTAL EST. PROJ. COST:** $380,000

PROJECT NUMBER: 11031 DSL **PPBS NO.** 1103

DESCRIPTION OF PROJECT:

Natural permeable underground strata in the South St. Paul area will be used to demonstrate their capacity for the temporary storage of both storm water and combined storm water and sewage during periods of storm runoff. Deposits of alluvium, or gravel, which are approximately 100 feet in depth are to be located for this purpose by drilling in favorable locations.

Prior to introduction of the waste waters into the ground, they must be treated by removal of suspended solids, and will be chlorinated, if necessary, to eliminate danger of contaminating adjacent sources of water supply. The capacity for rapid pre-treatment and movement of large volumes of waste water into the ground must be demonstrated if the system is to prove feasible.

Waste water thus entering the ground during storms will be pumped out over a period of several months. If the quality of this water meets the required standards, it can be returned directly to the streams. Otherwise, it will be transported to the sewage treatment plant.

Prior to introduction of waste water into the underground formation, city water will be used to test the direction, rate of movement, and quality of water in the ground through use of observation wells.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
[illegible]
Washington, D. C. 20242

INFORMATION SHEET

____
Date to be Released

RESEARCH, DEVELOPMENT, OR DEMONSTRATION PROJECT

This Project is a Grant ______, under Section 6a1 ______, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE OR CONTRACTOR: The City of LaSalle, Illinois
(Name and Address)

PROJECT DIRECTOR: (Name and Address)
Chamlin and Associates
3017 Fifth Street
Peru, Illinois 61354

TITLE OF PROJECT: "The Construction and Technical Evaluation of the Various Aspects of an Aluminum Storm Sewer System"

PROJECT SITE: LaSalle, Illinois

PROGRAM (PROJECT) NUMBER:
11032DTI

DATE OFFERED:
June 13, 1969

DATE ACCEPTED (AWARDED):
June 23, 1969

Grant or Contract Period	Eligible Grant Period Costs	FWPCA Grant or Contract Amount
From: 6/23/69 Thru: 11/23/72	Total $958,068 $ Eligible $476,368	$ 432,276

DESCRIPTION OF PROJECT:

The City of LaSalle will demonstrate the correction of combined sewer overflow problems by constructing a separate storm drainage system for a portion of the city. Engineering study indicates that this is the most economical solution for LaSalle. The development and demonstration aspects will be:

(a) The installation and evaluation of performance, durability and dependability of various size corrugated aluminum pipe, (b) prototype development and evaluation of improved joint couplers, tapping saddles, catch basins and manholes, (c) a detailed cost analysis to allow comparison of aluminum pipe with commonly used sewer material, and (d) a construction practice evaluation for future installation guidance.

INQUIRIES: Contact Project Coordination
Office of Research and Development
Federal Water Pollution Control Administration
U. S. Department of the Interior
Washington, D. C. 20242

c. 1104 Non-Sewered Runoff

GRANTS

GRANTEE	PROJECT OFFICER	PROJECT MANAGER	PAGE
University of Michigan, 11041 DRS	Robert Buckley	George Kirkpatrick	102

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE: The Regents of the University of Michigan
Ann Arbor, Michigan

TITLE OF PROJECT: "Rainfall-Runoff Relations on Urban (and Rural) Areas"

PROJECT SITE: Detroit, Michigan

DATE AWARDED:

FEDERAL GRANT: $18,986

TOTAL EST. PROJ. COST: $20,085 (1968-69)

PROJECT NUMBER: 11041 DRS

PPBS NO. 1104

DESCRIPTION OF PROJECT:

Objectives of the project are to gain a better understanding of the factors which control the relationship between storm rainfall, or snow melt, and the resulting storm runoff, and to determine the effect of urbanization on this runoff process. The benefits would include prevention of flood damage by means of improved design of storm sewers and waterways, and would provide data needed for the improved design and operation of facilities for control of pollution due to storm water and/or combined sewage.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
Washington, D. C. 20242

d. 1503 Control of Pollution from Construction

GRANTS

GRANTEE	PROJECT OFFICER	PROJECT MANAGER	PAGE
National Association of Counties, 15030DTL	Darwin Wright	Darwin Wright	104

INFORMATION SHEET --

RESEARCH & DEVELOPMENT GRANT

This sheet describes briefly an R & D Grant awarded under Sec. 6, Federal Water Pollution Control Act (Clean Water Restoration Act).

GRANTEE: National Association of Counties - Research Foundation
1001 Connecticut Avenue, N.W.
Washington, D.C. 20036

TITLE OF PROJECT: "Community Action Guide for Erosion and Sedimentation Control"

PROJECT SITE: Washington, D.C.

DATE AWARDED: February 11, 1969

FEDERAL GRANT: $41,343

TOTAL EST. PROJ. COST: $56,543

PROJECT NUMBER: 15030DTL

PPBS NO. 1503

DESCRIPTION OF PROJECT:

The National Association of Counties-Research Foundation will develop a "Community Action Guide for Erosion and Sedimentation Control" to impress on local officials by providing comprehensive information on all aspects of planning, operations, financing, staffing and management of such programs. Successful case studies will be reviewed and evaluated. In addition, the grantee will prepare a preliminary State-of-the-Art report on erosion and sedimentation control for urban and rural problems based upon knowledge gained during interviews for the "Guide". Specific Research and Development needs will be defined.

INQUIRIES: *Contact the* Storm and Combined Sewer Pollution Control Branch
Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Ave. N.W.
Washington, D. C. 20242

SECTION 4

U.S. DEPARTMENT OF THE INTERIOR

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

PERTINENT AREAS FOR RESEARCH AND DEVELOPMENT

STORM AND COMBINED SEWER POLLUTION CONTROL

JULY, 1968

The problem of pollution from storm and combined sewers is one which has only recently begun to receive proper emphasis as a significant pollution source. There are in the United States over 1900 communities with combined or partially combined sewerage systems serving some 59 million people.

The discharge of polluting wastes from storm drainage systems and overflows from combined sewers serves as a distinct challenge to the ingenuity of minicipal officials, consulting engineers, universities and corporations engaged in research and development, as well as equipment manufacturers. Polluting discharges from combined storm and sanitary sewers occur during wet-weather periods when the carrying capacity of the sewers is exceeded due to the large amounts of storm water entering the sewers. The normal, or dry weather flow is prevented from overflowing continuously by means of overflow weirs, mechanical regulators, valves and other devices. They permit overflows to occur when sewer flows reach a predetermined level.

Separation of the storm water from the sanitary sewage can be at least a partial answer to the problem since if the systems are completely separated the most concentrated waste load can be conveyed to and treated at the waste treatment plant. We have come to recognize in recent years, however, that surface runoff also contains significant amounts of pollutants - some cases nearly as much as sewage - so that separation of sanitary wastes is now believed to be only a partial solution to the total problem.

Congress had these factors in mind when the current storm and combined sewer pollution control demonstration grants were authorized. Section 6 (a) (1) of the Federal Water Pollution Act authorizes "---- grants to any State, municipality, or intermunicipal or interstate agency for the purpose of assisting in the development of any project which will demonstrate a new or improved method of controlling the discharge into any waters of untreated or inadequately treated sewage or other wastes from sewers which carry storm water or both storm water and sewage or other wastes ----." The Federal Government can provide up to 75 percent of the estimated reasonable cost of individual research, development and demonstration projects. The applicant must provide assurances that local funds are or will be available to pay for the remainder of the cost. Application for contract support for pertinent research and development projects will also be considered.

The necessary application forms and more detailed information concerning the Program can be obtained by writing to:

Office of Research and Development
Federal Water Pollution Control Administration
U.S. Department of the Interior
633 Indiana Avenue, N. W.
Washington, D. C. 20242

By way of assisting those who wish to participate in the task of controlling or abating pollution from storm and combined sewers the following outline of technical areas for which applications are desired is provided:

A. DRAINAGE AREA CONTROL

1. Reduce and regulate stormwater input to sanitary sewers

    a. Diversion of surface runoff to the ground water by altering and controlling land use to increase infiltration
        1. Reduction of impervious areas - increasing open spaces
        2. Terracing and otherwise reducing land slopes through landscaping
        3. Planting grasses, trees and shrubbery
        4. Reducing extent and time of exposure of bare earth during land development and construction

    b. Shallow pervious basins for percolation to ground water or use sprinklers

    c. Ground water disposal wells (injection & others)

    d. Reduction of ground water infiltration to sewers
        1. Development of better methods of determining location and extent of sewer infiltration
        2. Development of better sewer joints, lateral connections, etc.
        3. Development of better methods of repairing existing lines, making new installations and closing of abandoned connections

    e. Storage of stormwater runoff
        1. Temporary storage of stormwater at building or immediate area through use of holding tanks, seepage pits, rooftops, or backyard storage (detention) facilities. Regulated discharge from storage to the groundwater, a watercourse, or sewer system
        2. Stormwater collection sumps (neighborhood) with regulated discharge to sewer system (includes storage facility under streets)
        3. "Upstream" storage or other control methods to decrease runoff effect on lower portions of the system
        4. Stormwater storage in urban area surface lakes, ponds, caverns, for subsequent discharge to watercourse or sewer systems
        5. Storage and operating characteristics necessary for snowmelt runoff
        6. Reuse of stored water for irrigation, street cleaning, sewer flushing and other purposes

2. Eliminate discharge of sanitary sewage and other wastes to storm sewers

    a. Eliminate illicit connections of sanitary sewers where separate sewers exist

    b. Reduce groundwater infiltration to storm sewers

    c. Separation and collection of concentrated waste materials on the surface for discharge to sanitary or industrial waste sewers. (Animal waste, industrial materials and waste projects, sludges, etc.)

3. Reduce solids in storm runoff

    a. Soil erosion control
        1. Highway, street, and utility construction methods and practices changes
        2. Use of solids retaining pond, basin, or other type unit with necessary treatment
        3. Grass seeding and other type plant coverage of exposed earth

    b. Improved street cleaning and urban "housekeeping" methods to prevent solids from reaching the sewers

4. Pre-treatment of water entering storm sewers

    a. Disinfection only

    b. Primary clarification with modifications (with and without chlorination or other type disinfectants)

    c. Lagoons, ponds, tanks with solids holding capacity for given period

    d. Filtration

    e. Treatment for nutrient removals

    f. Treatment or storage in catch basins

    g. Other treatment methods and processes or combinations of the above including chemical treatment

B. COLLECTION SYSTEM CONTROL

1. Improvements in gravity sewer system

a. Catch basin improvements including operation and maintenance practices

b. Sewer planning and controls to regulate time of flow during heavy stormwater periods, including sewer flood flow routing techniques, travel time, etc.

c. Improved sewer shapes and materials to improve flow conditions, (lower "n") better sewer connections and manhole flow channels

d. Increase trunk and interceptor design capacity

e. Improved system design methods utilizing best hydrological practices

2. Special conveyance systems

a. Limited separation of combined sewers with express sewer construction for sanitary waste

b. Partial separation
   1. Separate drains for streets, yards, parking lots, new buildings, etc.
   2. Phased separation of sewer systems in all new areas to be sewered and redeveloped. While this method could have significant long-range beneficial effects, demonstration grants for separation of sewers are not envisioned
   3. Preventing stormwater flows in separate systems from being discharged to combined sewers

c. Separation of sanitary sewage and use of separate sewer inside larger sewers where available to convey sewage to treatment plant

d. Use of vacumm conveyance systems for sanitary sewage & solid wastes

e. Others

3. Reduce peak flows

a. Diversion of excess flow from combined sewer to external facilities for storage and regulated feed back to system for treatment

b. In-line treatment to improve flow conditions

c. In-line detention through use of enlarged segment of sewer

d. In-system detention of waste and stormwater through telemetering or other type signaling systems with remote control on flow.

e. Reduction in water use through improvements in plumbing fixtures

4. Reduce infiltration and exfiltration

   a. Development of improved methods of locating sewer leaks; checking out new sewers, laterals and house lines

   b. Development of new and better methods and materials for making sewer repairs, closing abandoned openings and construction in general

   c. Development of methods of sealing sewers in place, internally and externally, to reduce infiltration

   d. Improved means of implementing control of illicit "clearwater" connections to sewers

5. Systems analysis and control methods

   a. In-line (internal) storage with telemetering and remote or automatic flow control

   b. External storage in tanks, ponds, etc. for feed back with automatic control system

   c. In-system routing of stormwaters to utilize full storage capacity of system and subsequent treatment

   d. Others and combinations of (a), (b), (c) (Including periodic dry weather flushing to move solids deposited in sewers, and better sewer maintenance in general)

C. EXTRANEOUS (EXTERNAL) DISCHARGE CONTROL

1. Treatment of combined sewer overflow

   a. Treatment at or near point of overflow through use of conventional type primary treatment units or ponds, tanks, lagoons with chemical treatment and chlorination. Other types of treatment facilities or processes.

   b. Use of subterranean holding basins with treatment facilities

   c. Expansion or additions to existing treatment plants to treat excess flow

   d. Nutrient removal

   e. Treatment with return of concentrate to interceptor for further treatment at sewage treatment plant

2. Treatment of stormwater runoff

   a. Small drainage area plants vs. central plant utilizing new or improved methods of treatment

   b. Utilization of upstream storage to cut peaks and control plant input

   c. Pre-treatment and direct ground water replacement

   d. Irrigation by spreading, spray or other methods

   e. Treatment and use as supplement to raw water supply

   f. In-line treatment

   g. Others

D. MISCELLANEOUS

1. Determination of economic feasibility study of separation vs. combined sewer system and local vs. central treatment facilities for overflow and stormwater.

2. Development and demonstration of new or improved accurate instruments for flow measurement and water quality monitoring.

3. Development and demonstration of improved techniques of hydrologic analyses, to determine reasonable accurate rainfall - runoff relationships. Compilation of sources of existing data and development of improved statistical methods.

4. Management techniques geared to optimize control and/or treatment through utilization of new methods.

5. Development of improved construction materials and methods

6. Development of performance criteria needed in relationship to stream water quality standards

It should be noted that the above outline is not considered to be all-inclusive, since there may be numerous completely original ideas which could be added -- some of which may be more significant than any of those listed. Submission of such ideas to the Federal Water Pollution Control Administration is strongly encouraged.

Some of the technical areas outlined are currently under evaluation by means of either grant or contract projects, for example: Most of the more conventional storage techniques including the use of tanks with pump-back to the interceptor, surface storage ponds, treatment lagoons are underway. More unique applications of storage principals such as localized "upstream" storage to prevent overloading of "downstream" sewers need further development. The use of chlorine to disinfect storm and combined sewer discharges is included in several projects, therefore new disinfection techniques suitable for application to high volume -- short duration flows need exploration. Similar examples can be found in any of the major technical areas listed.

The brief descriptions of existing demonstration projects will serve as additional examples of work being done. Any further duplication of these control methods will be minimized as much as possible to permit activation of projects designed to explore technical areas not now being evaluated. Some duplication will be in order so as to provide evaluation of function under a suitable variety of hydrological conditions.

GPO 881-412

SECTION 5

URBAN DRAINAGE RESEARCH AND DEVELOPMENT IN THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

Program Plan for Urban Drainage Projects in the Storm and Combined Sewer Pollution Control Branch, Division of Engineering Development

Outline of Requirements for Equipment, Data, Methods, and Criteria

I. Instrumentation - Equipment for obtaining hydrologic measurements and chronologic records

   A. Measurement of individual parameters

      1. Precipitation--rain and snow

      2. Flow in sewers and streams

         a. Very low flows

         b. Flash floods

         c. Sand channels

      3. Time of travel in sewers and streams

      4. Fluid turbulence and dispersion

      5. Chemical and bacterial quality, sediments, and bed load

      6. Soil moisture

      7. Other

   B. Time - synchronous measurements of parameters, such as synchronized measurement of rainfall and flow at short time intervals for rainfall-runoff analyses in small basins

   C. Transmission of data

   D. Adaptation of equipment to automatic data processing, particularly the development of equipment to collect rainfall records and to transfer them automatically to a machine input media

II. Data Collection

   A. Compilation of existing rainfall and flow data of sufficient geographic distribution, length of record, and temporal and quantitative accuracy for deriving useful rainfall-runoff relationships

   B. Compilation of existing data on quality of flows in combined sewers and streams. Include data on quality of low flows and distribution of quality with time and discharge during periods of storm flow

   C. Classification and selection of urban areas for the collection of basic hydrologic data

   D. Development of theory for the design of hydrologic data networks

   E. Implementation of pilot programs for the collection of basic hydrologic data

F. Nationwide inventories of existing drainage systems. These may include complete descriptions of the systems, data on construction costs, including design and engineering, evaluation of performance, flood damage experience, outstanding deficiencies, methods of financing, esthetic characteristics, public understanding and acceptance, public health hazards, recreational aspects, legislation and ordinances affecting the system, and administrative and operational experience.

III. Rainfall Studies and Analyses

A. Determination of basin rainfall from point gage readings

B. Temporal distribution of rainfall

C. Synthesis of rainfall data

D. Storm models and techniques for estimating probable maximum floods in areas of limited data

IV. Hydrology and Hydraulics of

A. Surface Runoff and Combined Sewers

1. Rainfall-runoff relationships

a. Consideration of rainfall patterns in estimating runoff from rainfall

b. Estimation of losses from rainfall on small watersheds

c. Geometry and morphology of a stream basin in relation to hydrologic characteristics

d. Methods for estimating peak rates of runoff and for development of runoff hydrographs from small areas

(1) Parametric methods

(a) Correlation analysis

(b) Partial system synthesis with linear analysis

(c) General system synthesis

(d) General non-linear analysis

(2) Stochastic methods

(a) Markov chains

(b) Monte Carlo methods

    - e. Spectral properties of rainfall-runoff relationships
    - f. Surface treatment of small watersheds to modify runoff
    - g. Effects of frozen ground on flood runoff
    - h. Soil-moisture effects

2. Runoff from snow melt

3. Frequency of flows
    - a. Methods for determining the frequency of peak flows and storm volumes in small streams, combined sewers, and combined sewer overflows
    - b. Methods for determining the frequency of low flows in small streams

4. Flood routing
    - a. Improved methods of flood routing, including a procedure for reproduction of the rapidly rising stages that often occur during floods
    - b. Overland sheet flow--a routing problem

5. Travel time
    - a. Use of fluorescent and radioactive tracers in measuring the time of travel of flows in streams and combined sewers
    - b. Use of tracers to study time of concentration of flood flows

6. Turbulence, dispersion
    - a. Development of techniques for measuring turbulence in streams
    - b. Use of tracers in studying dispersion
    - c. Determination of regional patterns of dispersion
    - d. Effect of stream inlets on main stream or reservoir

7. Radioactive and chemical tracers
    - a. Relating the movement of soluble tracers in streams to the movement of water
    - b. Determining the physical characteristics of fluorescent tracers in streams

    c. Effects of chemical and radioactive tracers on biota in streams
    d. Determining absorption characteristics of radioactive tracers
    e. Determining the effect of large-scale channel features on dispersion of soluble tracers in streams
8. Estimating the magnitude of diurnal fluctuation in stream flow
9. Effect of transported materials on the estimate of flood discharges
10. Measurement of unsteady flow in streams and channels
11. Mathematical representation of hydrographs
12. Erosion, sedimentation
    a. Shear distribution on stream boundaries
    b. Erosion and sediment yield from land surfaces by precipitation
    c. Land sources of solutes and sediments
    d. Physics of sediment transport in overland and channel flow
    e. Sediment routing through channel and flood plains
    f. Data on minimum transport velocities in combined sewers
    g. Effects of manholes, junctions, inlets, bends, drops, etc. on the transport of solids in combined sewers
    h. Methods for the control of erosion
13. Improvement of flow characteristics
    a. Use of additives such as long-chain polymers
    b. Control of aquatic growth
    c. Improved structural design of drains and combined sewers
    d. Methods of sewer inspection and maintenance
    e. Alteration of combined sewer routing to reduce downstream flow variability
    f. Diversion of flood flows from urban areas through bypass channels

14. Water quality studies

    a. Developing a general model for determining oxygen profiles in streams and estuaries

    b. Chemical and physical processes affecting water quality

    c. Biologic processes affecting water quality

    d. Mechanical processes affecting water quality

B. Surface Storage

1. Use of flood volume - duration - frequency analyses to determine flood storage requirements

2. Storage requirements to maintain selected flows

3. Evaluation of ecological and limnological characteristics of lakes and ponds

4. Optimum procedures of reservoir and pond control for reduction of sediment and temperatures

5. Effect of streamflow regulation on downstream channel losses

6. Effect of ponding behind a series of dams on water quality

7. Streamflow regulation for quality control

8. Study of unique storge space, such as on roof tops

C. Ground - Water Storage

1. Determining the feasibility of methods of directing stormwater flow to underground aquifers

2. Investigating the feasibility of water spreading for conservation of water

3. Determining efficient techniques for recharging groundwater from surface runoff

4. Developing the mechanics of flow in unsaturated porous media

5. Study of surface water - groundwater interrelations

6. Study of sewer flow and groundwater interrelations

7. Investigating the retention and movement of water in fine-grained material

8. Analysis of the physical properties of porous media that influence the occurrence, storage, and movement of water

    9. Study of changes occuring in the properties of porous media as water moves through the media

V. Development of Statistical Methods

  A. Characterization of univariate hydrologic series-time series analysis

  B. Statistical identification of hydrologic characteristics and relationships

  C. Hydrologic systems analysis using stochastic methods--mathematical simulation and modeling, optimization, and decision theory

VI. Systems Studies

  A. Experimental watersheds (A.G.U. definition)

  B. Representative watersheds (A.G.U. definition)

  C. Use of physical models

  D. Use of mathematical models

VII. Organization for Urban Drainage Management

  A. A study of the feasibility and means by which public agencies responsible for urban drainage in large metropolitan areas could coordinate their activities to attain greater efficiency and economy

    1. Identification of items which could be included in agreements between existing public agencies in a region

    2. Management patterns inherent in organizational alternatives

  B. Preparation of a summary of State enabling legislation establishing drainage districts and authorities

  C. Research to determine the proper level of organization for drainage management

VIII. Economics of Urban Drainage

  A. Economic systems analysis of the urban drainage complex

  B. A program of research into the area of benefits and cost sharing between various levels of government and private land developers

  C. Development of methods for evaluating and quantifying intangible benefits, or alternate solutions for attaining realistic costbenefit analyses in urban storm drain design

- D. A study of the comparative costs and benefits of developing multi-purpose impoundments to control runoff, versus the loss of land to flood plains when no such impoundments are provided
- E. Compile data on cost of constructing storm drains
- F. Record data on flood damage caused by inadequate storm drains
- G. A critical study of the economics of research into improved hydrologic methods as compared with continued use of present practices

IX. Planning Urban Drainage

- A. An analysis of master plans prepared and adapted in many communities for drainage control with a summary of the major considerations which must be included in the preparation of a good master plan
- B. Compilation and analysis of typical zoning plans as they relate to flood plains and drainage
- C. Factors to be considered in the preparation of zoning plans
- D. A study of methods used to coordinate plans and programs for storm drainage between the various public agencies of the metropolitan area
- E. Study how planning for storm water drainage can be integrated with comprehensive planning for urban areas

X. Financing Capital Improvement of Urban Drainage

- A. A study of alternate methods of financing storm drainage improvements
- B. An analysis and summary of federal aid financing programs

XI. Legal and Regulatory Aspects of Urban Drainage

- A. A compilation and analysis of typical drainage control ordinances of counties, cities, and towns including the preparation of model ordinances which may be applicable to the needs of various levels of governments and agencies
- B. A compilation and analysis of erosion and siltation control ordinances including the preparation of model ordinances
- C. Regulatory measures for pollution control
- D. Flood insurance provisions

E. Legal devices for control of water and related land rights

XII. Esthetics of Urban Drainage

A. Landscaping, park development along the drainage system

B. Appropriate and attractive design of structures

C. Elimination of polluted open waterways

D. Use of drainage water for development of recreational lakes and ponds

XIII. Public Support for Improved Facilities - Psychological and social research in methods of understanding public attitudes and gaining public support

XIV. Information Storage and Retrieval

A. Development of systems similar to the Storet system for handling various kinds of data

B. Development of schemes for transferring various systems to a common format

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2 Subject Field & Group
05G, 05E, 09D

SELECTED WATER RESOURCES ABSTRACTS
INPUT TRANSACTION FORM

5 Organization
Federal Water Pollution Control Administration, Washington, D.C.
Divi~~sion~~ of Applied Science and Technology.

6 Title
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10 Author(s)
Rosenkranz, William A.

16 Project Designation
FWPCA Project 11000---12/69

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25 Identifiers (Starred First)
Combined sewers.

27 Abstract
Studies sponsored by FWPCA of combined storm and sanitary sewers and treatment of combined wastes are listed, abstracts of completed reports are presented, and active projects are described in information sheets. Subjects needing more research are also listed and described. Equipment, data methods, and criteria for urban drainage projects are outlined. (Knapp-USGS)

(WRSIC ABSTRACT)

Abstractor George Knapp 4-6-70
Institution U. S. Geological Survey, Water Resources Div.

WR:102 (REV. JULY 1969)
WRSIC

SEND TO: WATER RESOURCES SCIENTIFIC INFORMATION CENTER
U.S. DEPARTMENT OF THE INTERIOR
WASHINGTON, D. C. 20240

* GPO: 1969-359-339